Contemporary Systems Thinking

Yi Lin
Bailey Forrest

Systemic Structure Behind Human Organizations

From Civilizations to Individuals

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Contemporary Systems Thinking

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Systemic Structure Behind Human Organizations

From Civilizations to Individuals

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Preface

It was the year of 1979 when Yi Lin, the first author of this book, was a sophomore in college majoring in Mathematics. According to the requirement of the national Department of Education he took 23 credit hours for each of the semesters in the university so that he had a chance to experience quite a few professors of varied characters. Although still not clear about what the future held for him in that career path, the different teaching styles and personalities of the professors made him feel curious about what a successful mathematician really did in his or her career. To satisfy this curiosity, he spent the winter break of that year on Morris Kline's wonderful book, "Mathematical Thoughts from Ancient to Modern Times," (Oxford university Press, 1972). Through additional readings along similar lines in the following years, he realized among many other facts that natural science, in particular, physics was an "exact" science because of Newton's laws of motion and that social science was not nearly as "exact" as natural science due to the absence of similar laws.

As he was soon greatly influenced by the teaching of Shutang Wang, a general topologist, and inspired by a paper by George Klir, a well-known scholar in systems science, Yi Lin started his professional career in systems research hoping that one day he could have the luck to introduce the badly needed laws for social science or maybe such laws that could make both natural and social sciences exact at the same time.

During the two years before the publication of his edited volume, entitled "Mystery of Nonlinearity and Lorenz's Chaos," in 1998 by Kybernetes, the International Journal of Cybernetics and Systems, as a double special issue, the idea of a spinning system began to germinate in his head. However, there were still a lot of holes in the thinking. Along with the successful publication of the said volume, well over a thousand communications from scholars from all over the world helped him to crystallize his idea and finally a three-dimensional visualization of the model was placed on the front cover of his 2002 book (joint with Y. Wu), entitled "Beyond Nonstructural Quantitative Analysis: Blown-Ups, Spinning Currents and the Modern Science," published by World Scientific.

In 2008 Yi Lin successfully finalized the perceived spinning systemic model and named it (Chinese) yoyo due to its general shape in the three-dimensional space in the highly regarded paper, "Systemic yoyo model and applications in Newton's, Kepler's laws, etc.," (Kybernetes: the International Journal of Cybernetics, Systems and Management Science, vol. 36, no 3–4, pp. 484–516). As what had been dreamed about for many years, in this paper, Lin employed this new model of systems to generalize Newton's laws of motion into four laws on the state of motion of general materials. After that he walked through Kepler's laws of planetary motion, Newton's law of universal gravitation, and provided a brand new explanation for why planets travel along elliptical orbits, why no external forces are needed (in the traditional science, external forces are always needed) for celestial systems to resolve about one another, and why binary star system, tri-nary star systems, and even n-ary star systems can exist in the physical reality, for any natural number $n \geq 2$.

Continuing on this initial success, Yi Lin joined hands with a colleague to apply this model to the study of economics, a part of social science, by first proving a sufficient and necessary condition under which Becker's rotten kid theorem (a piece of Nobel Prize winning work in Economics) holds true in general (Y. Lin and D. Forrest (2008). Economic yoyos and Becker's rotten kid theorem. Kybernetes: The International Journal of Cybernetics, Systems and Management Science, vol. 37, no. 2, pp. 297 - 314). With the joint hands in the research team of Wujia Zhu, Ningshen Gong, and Guoping Du, Yi Lin published an edited volume in 2008 as a special double issue in Kybernetes (vol. 37, nos. 3–4, pp. 387–578), entitled "Systematic Studies: the Infinity Problem in Modern Mathematics." In this issue, the yoyo model is successfully applied to the study of human thoughts, leading to the discovery of the fourth crisis in the foundations of mathematics. Additionally, these four authors clearly prove that by distinguishing the concepts of actual and potential infinities, the second and the third crises of the past of the foundations of mathematics were not really resolved as historically believed.

What had been achieved in classical physics, the study of the three-body problem, the Becker's rotten kid theorem, and the foundation of mathematics convincingly reveals to Yi Lin and his colleagues the following fact. In the past 80 some years, the difficulty experienced in the research of systems science and the relevant low progress are mainly due to the lack of a convenient intuition and a common playground on which important scientific conclusions on general systems could be established. In particular, in the investigation of systems, there is an urgent need to develop a model similar to that of the Cartesian coordinate system available for modern science, all magnificent results of which are established on the Cartesian coordinate system. In 2008, Yi Lin provided a systematic presentation of all the results related to the yoyo model and its applications in nonlinear science, classical physics, corporate governance, household economics, child labor, foundations of mathematics, and practical civil engineering project design, and the prediction of (nearly) zero probability disastrous natural events, in his monograph "Systemic Yoyos: some Impacts of the Second Dimension," published

by Auerbach Publications, an imprint of Taylor and Francis. That is, what is shown in this monograph is that with the systemic yoyo model well established, the research of general systems can truly take its hold as the second dimension of science, as argued by George Klir in the early 1990s (Facets of Systems Science, Springer, New York, NY), with the traditional science as the first dimension.

Riding on the previous successes with the systemic yoyo model, Yi Lin joined hands with Bailey Forrest to explore the possibility of applying the laws on state of motion of general materials to the study of humans and their organizations of different scales. Different from the conventional studies in social science, where statistics has been the tool of analysis so that only organizations of small scales could potentially be considered with relatively reliable results derived, what is presented in this book provides a brand new approach to the investigation of human organization of any magnitude. With the conclusions derived thereafter, statistics will be potentially usable for reconfirming whatever theoretical results established using the systemic yoyo methodology, if adequate and meaningful data could be collected.

It is our hope that you will benefit from reading this book and referencing this book time and again in your professional endeavors. At the same time we would love to hear from you no matter what your comments or suggestions might be. Yi Lin, the first author, can be reached at either Jeffrey.forrest@sru.edu or Jeffrey.forrest@iigss.net.

December 24, 2009

Yi Lin
Bailey Forrest

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Yi Lin expresses his sincere appreciation to many individuals who have helped to shape his life, career, and profession. Since, there are so many of these wonderful people from all over the world, he will just mention a few. Although Dr. Ben Fitzpatrick, his PhD degree supervisor, has left this material world, he will forever live in Dr. Yi Lin's works. His teaching and academic influence will continue to guide him for the rest of his professional life. His heartfelt thanks go to Shutang Wang, his MS degree supervisor. Because of him, Yi Lin always feels obligated to push himself further and work harder to climb high up the mountain of knowledge and to swim far into the ocean of learning. To George Klir—from him Yi Lin acquired his initial sense of academic inspiration and found the direction in his career. To Mihajlo D. Mesarovic and Yasuhiko Takaraha—from them Yi Lin was affirmed his chosen endeavor in his academic career. To Lotfi A. Zadeh—with personal encouragements and appraisal words Yi Lin was further inspired to achieve high scholastically. To Shoucheng OuYang and colleagues in their research group, named Blown-Up Studies, based on their joint works; Yong Wu and Yi Lin came up with the systemic yoyo model, which eventually led to completion of the earlier book *Systemic Yoyos: Some Impacts of the Second Dimension* (published by Auerbach Publications, an imprint of Taylor and Francis in 2008) and this book. To Zhenqiu Ren—with him Yi Lin established the law of conservation of informational infrastructure. To Gary Becker, a Nobel laureate in

economics—his rotten kid theorem has brought Yi Lin deeply into economics, finance, and corporate governance. Also, both the authors of this book would like to use this opportunity to express their sincere appreciations to those colleagues who had critically reviewed the previous drafts of this work. Their constructive comments have indeed helped to make the final version of this book better and more reader friendly.

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About the Authors

Dr. Yi Lin also known as Jeffrey Yi-Lin Forrest, holds all his educational degrees (BS, MS, and PhD) in Pure Mathematics from Northwestern University (China) and Auburn University (USA) and had one year of postdoctoral experience in Statistics at Carnegie Mellon University (USA). Currently, he is a guest or specially appointed professor in economics, finance, systems science, and mathematics at several major universities in China, including Huazhong University of Science and Technology, National University of Defense Technology, Nanjing University of Aeronautics and Astronautics, and a tenured professor of mathematics at the Pennsylvania State System of Higher Education (Slippery Rock campus). Since 1993, he has been serving as the president of the International Institute for General Systems Studies, Inc. Along with various professional endeavors organized by him, Dr. Lin has had the honor to mobilize scholars from over 80 countries representing more than 50 different scientific disciplines.

Over the years, he has served on the editorial boards of 11 professional journals, including Kybernetes: The International Journal of Systems, Cybernetics and Management Science, Journal of Systems Science and Complexity, International Journal of General Systems, and Advances in Systems Science and Applications. And, he is a co-editor of the book series entitled "Systems Evaluation, Prediction and Decision-Making," published Taylor and Francis since 2008.

Some of Dr. Lin's research were funded by the United Nations, the State of Pennsylvania, the National Science Foundation of China, and the German National Research Center for Information Architecture and Software Technology.

By the end of 2008, he had published nearly 300 research papers and over 30 monographs and edited special topic volumes by such prestigious publishers as

Springer, Wiley, World Scientific, Kluwer Academic (now part of Springer), Academic Press (now part of Springer), and others. Throughout his career, Dr. Yi Lin's scientific achievements have been recognized by various professional organizations and academic publishers. In 2001, he was inducted into the honorary fellowship of the World Organization of Systems and Cybernetics.

Professor Yi Lin's professional career started in 1984 when his first paper was published. His research interests are mainly in the area of systems research and applications in a wide-ranging number of disciplines of traditional science, such as mathematical modeling, foundations of mathematics, data analysis, theory and methods of predictions of disastrous natural events, economics and finance, management science, philosophy of science, etc.

Mr. Bailey Forrest is a freelance scholar. He has worked intensively in the areas of technology, computer science, and humanity. As of the completion of this book, he has published works in studies of civilizations and human minds.

Book Overview

Since the early 1900s when the concept of systems was initially introduced in biology, in the past century this concept has been well accepted by scholars from the entire spectrum of modern science and technology. And starting in the 1990s, based on the then-current progress in the relevant areas, systems research has been seen as the second dimension of science, as argued by George Klir, complementing classical science, the first dimension, in a completely different direction. Due to the special nature different from that of classical science, works and results of systems science have found their applications and impacts in a wide range of traditional disciplines, which are formed based on the objects studied. Riding on the successes of systems science of the past century, this book systematically presents how the recent systemic yoyo model, its thinking logic, and its methodology can be employed as a common playground and intuition for this second dimension of science by establishing a uniformed theoretical framework for the investigation of human organizations. The role of this model in systems research is analogous to that of Euclidean spaces in classical science, because it provides a platform for conceptual manipulation in systems research and helps to establish classical models to resolve problems from the first dimension.

After the introduction of the relevant historical grounds, this volume consists of four parts. The first part contains the theoretical and empirical foundations and justifications of this systemic yoyo model, followed by the development of the laws on the state of motion of materials. These laws generalize Newton's laws of motion of classical mechanics. The second part focuses on the investigation of civilizations by applying the properties of the yoyo model and the laws on state of motion by addressing a whole series of intriguing problems, such as how civilizations or cultures form, what makes some civilizations contain few political units and others many, why the Western democracy was not originated or appeared naturally in any other parts of the world, etc. The third part studies behaviors of business enterprises by uncovering the underlying systemic structures that dictate the evolution of individual firms. And the fourth part looks at the endowments of the human mind: self-awareness, imagination, conscience, and free will, and several other important attributes of people, such as character, thought, happiness,

fear, and the value of forced struggle. One of the most important results obtained in this last part shows how ambition, drive, and self-confidence, the key characteristics of any world class performers, could be installed in any person of average intelligence.

By looking at these three different levels of human organizations, this book shows that there are laws of nature, such as those on the state of motion of materials, and a uniform language and logic of reasoning, which can be equally employed in the studies of natural and social sciences. And, by employing these, one can surely produce interesting, convincing, and scientifically sound results. As shown in this book, many of the conclusions drawn on the basis of these laws, language, and logic can be practically applied to produce tangible economic benefits.

By studying this book, the reader will walk away with the knowledge of a brand new tool to attack his or her problems and a collection of practically useful knowledge and conclusions.

Chapter 1
Introduction

In 1924, von Bertalanffy formally introduced the concept of systems in biology by stating provokingly that

> Because the fundamental character of living things is its organization, the customary investigation of individual parts and processes cannot provide a complete explanation of the phenomenon of life. This investigation gives us no information about the coordination of parts and processes. Thus the chief task of biology must be to discover the laws of biological systems (at all levels of organization). We believe that the attempts to find a foundation at this theoretical level point at fundamental changes in the world picture. This view, considered as a method of investigation, we call "organismic biology" and, as an attempt at an explanation, "the system theory of the organism."

By pondering over this statement carefully, it becomes quite clear that such a challenge indeed exists in every corner of the spectrum of modern science as soon as one replaces "living things" by "physical matters" or "social events", where each physical matter or social event does have a beginning, followed by a period of relatively stable existence, and ended in a moment of disappearance so that the phenomenon of life can be loosely observed in many areas of scientific research and human endeavor. As a matter of fact, the existence of such a challenge facing the entire modern science is evidenced by our inabilities in making reliable predictions about the future, no matter whether what we are about to foretell is regarding the nature or regarding the next stages of development of social events. The difficulty to foretell the forthcoming changes in nature indicates that modern science still cannot deal with transitional changes beyond the theories established on the concept of continuity. Our inability to foresee the next stages of development of social events implicitly indicates that when many forces interact nonlinearly with each other, the current linear science simply loses its validity and strength. To this end, see (Lin and OuYang 2010) for detailed discussions.

From this realization, in the past 80 some years, studies in systems science and systems thinking have brought forward brand new understandings and discoveries to some of the major unsettled problems in conventional science. For more details,

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see (Lin 1999; Klir 1985) and references therein. Due to these studies of wholes, parts, and their relationships, a forest of interdisciplinary explorations has appeared, revealing the overall trend of development in modern science and technology of synthesizing all areas of knowledge into a few major blocks, and the boundaries of conventional disciplines have become blurred (Mathematical Sciences 1985). Underlying these explorations, we can see the united effort of studying similar problems in different scientific fields on the basis of wholeness and parts, and of understanding the world in which we live by employing the point of view of interconnectedness. As having been tested in the past 80 plus years, the concept of systems has been widely accepted by the entire spectrum of science and technology (Blauberg et al. 1977; Klir 2001).

This chapter consists of three sections. In Sect. 1.1, we outline the relevant historical background of systems science [for a detailed treatment on the history of systems theory, see (von Bertalanffy 1968, 1972)], and why systems science can be seen as the second dimension of the totality of science, as argued by George Klir (2001). An understanding of the concept of systems makes it easier for the reader to follow the threads of thinking logic of this book; and the second dimensionality of systems science lays down the historical significance for the works presented in the following chapter. In particular, when studying dynamics in a 1-D space, there are incidences that cannot be resolved within the given space. For instance, when a 1-D flow is stopped by a blockage located over a fixed interval, the movement of the flow has to cease. However, if the flow is located in a 2-D space, instead of completely stopping the flow, the blockage would only create a local (minor) irregularity in the otherwise line movement. Additionally, if one desires to reach the inside of the blockage, he has to make use of the convenience of the second dimension. This example shows that with an extra dimension available, science will gain additional strength in terms of solving more challenging problems.

In Sect. 1.2, we will present the specific reasons and background information that lead to the introduction of the systemic yoyo model. In particular, in the past 80 some years of development, the so-called systems movement has suffered a great deal due to the reason that this new science does not have its own speaking language and thinking logic. Conclusions of systems research, produced in this period of time, are established either by using ordinary language discussions or by utilizing the conventional mathematical methods, making many believe that systems thinking is nothing but a clever way to rearrange conventional ideas. In other words, due to the lack of an adequate tool for reasoning, systems science and systems thinking have had been treated with less significance since the 1970s than they were thought initially (Berlinski 1976; Lilienfeld 1978). Considering the importance of the Cartesian coordinate system in modern science (Kline 1972; Wu and Lin 2002) realize that the concepts of (sizeless and volumeless) points and numbers are bridged beautifully together within the Cartesian coordinate system so that this system plays the role of intuition and playground for modern science to evolve; and within this system, important concepts and results of modern mathematics and science are established. Realizing the lack of such an intuition and playground for systems science, after presenting the main results of the blown-up

theory (Wu and Lin 2002), the systemic yoyo model (Lin 2007) is introduced in order for us to show, continuing what is presented in (Lin 2008b), in the rest of the book that this model is indeed a good candidate for serving as the intuition and playground for scholars to establish conclusions and results of systems science.

In Sect. 1.3, we outline how in the rest of this book the systemic yoyo model is applied to the investigations of civilizations, economic entities, and individual minds by addressing and answering some of the most intriguing questions unsettled in the past 100 and 1,000 years. That is, this book is organized in such a way that after the theoretical and empirical foundations of the systemic yoyo model are established for the convenience of the reader, the following chapters show how this model can be truly applied to the study of such inexact science as sociology as a convenient intuition and playground for the relevant analyses, while producing scientifically sound conclusions that can be used to generate tangible economic benefits. Historically, the basic idea of this yoyo model originates in the 1960s in Shoucheng OuYang's effort of forecasting extraordinary (near) zero probability torrential rains, an impossible task of modern science and technology (Lin 1998a) that has been made possible by using the systemic yoyo model (Lin 2008b).

1.1 The Concept of Systems

Similar to how the concept of numbers is introduced the concept of systems can be abstractly proposed out of any and every object, event, and process. For instance, behind a collection of objects, say, apples, there is a set of abstract numbers, such as 1, 2, and 3. Behind each organization or structure there is an abstract system within which the relevant whole, component parts, and the related interconnectedness are emphasized. That is, when internal structure can be ignored, numbers can be very useful; otherwise the world will be dominated by systems. To this end, a natural question is: What is a system? As implied by the previous sentence, the abstract concept lying beneath each organization or structure stands for a system, which brings together all the components into a meaningful relationship which acts as a whole. So, in the universe there are uncountable many kinds of systems; and anything or a collection of things in the universe could be seen as a system in some way. The next natural question is how to describe a system of specific interest by finding the system's boundary. In practice, this is done according to what the researcher wants to see as a system (Klir 1985). That is, a system is anything one sees as an entity with internal structure.

Now, let us look at what systems methodology entails. To this end, different scholars in the area of systems science have different takes. Even so, the fundamental points underlying these different understandings are roughly the same. For instance, Quastler (1965) wrote that

> Generally speaking, systems methodology is essentially the establishment of a structural foundation for four kinds of theories of organization: cybernetics, game theory, decision theory, and information theory. It employs the concepts of a black box and a white box (a white box is a known object, which is formed in certain way, reflecting the efficiency of the system's given input and output), showing that research problems, appearing in the afore-mentioned theories on organizations, can be represented as white boxes, and their environments as black boxes. The objects of systems are classified into several categories: motivators, objects needed by the system to produce, sensors, and effectors. Sensors are the elements of the system that receive information, and effectors are the elements of the system that produce real reactions. Through a set of rules, policies, and regulations, sensors and effectors do what they are supposed to do.

By using these objects, Quastler proved the following laws that could describe the common structure of the four theories of organization:

1. Interactions are between systems and between systems and their environments; and
2. A system's internal movements and the reception of information about its environment stimulates its efficiency.

In 1962, Zadeh listed the following problems as important for systems science: Systems characteristics, systems classifications, systems identification, signal representation, signal classification, systems analysis, systems synthesis, systems control and programing, systems optimization, learning and adaptation, systems liability, stability, and controllability. To Zadeh, the main task of systems science is the study of general properties of systems without considering their physical specifics; and systems methodology is that systems science is an independent scientific endeavor whose abstract foundation contains concepts and frameworks that are useful in the study of various behaviors of different kinds of systems. Therefore, systems science should be based on a theory of mathematical structures of systems with the purpose of studying the foundation of organizations and systems structures.

Although the concept of systems was first introduced formally in the second decade of the twentieth century in biology (von Bertalanffy 1924) and has been a fashionable topic of discussion in modern science and technology, like other concepts of science, its idea and thinking logic can be traced as far back in time as the recorded history goes. For example, Chinese traditional medicine, treating each human body as a whole, can be dated to the time of Yellow Emperor about 4,800 years ago; Aristotle's statement that "the whole is greater than the sum of its parts" represents a fundamental problem in systems science. That is, throughout the history, the mankind has been studying and exploring nature by using the thinking logic of systems with various time-specific terms. Only in modern times have some new contents been added to the ancient systems thinking. Additionally, the methodology of studying objects, matters, and events as wholes adequately agrees with the current development trend of modern science to divide the object of consideration into parts as small as possible and studying all of the individual

parts, seek interactions and connections between phenomena, and to observe and comprehend more and bigger pictures of nature.

In the scientific history, although the word "system" was never emphasized, one can still find many explanatory terms concerning the concept of systems. For example, Nicholas of Cusa, profound thinker of the fifteenth century, who linked Medieval mysticism with the first beginning of modern science, introduced the notion of *coincidentia oppositorum*, the opposition or indeed confrontation among the component parts within a whole that constitutes a unity of higher level. Leibniz's hierarchy of monads looks quite like that of modern systems; his *mathesis universalis* presages an expanded mathematics that is not limited to quantitative or numerical expressions and is able to formulate much conceptual thought. Hegel and Marx emphasized the dialectic structure of thought and of the universe it produces: the deep insight that no proposition can exhaust reality but only approaches its coincidence of opposites by the dialectic progress of thesis, antithesis, and synthesis. Gustav Fechner, known as the author of the psychophysical law, elaborated, in the way of the natural philosophers of the nineteenth century, superindividual organizations of higher order than the usual objects of observation—for example, life communities and the entire earth. On this work, he romantically anticipated the ecosystems of modern parlance. Other than these specific examples, see (von Bertalanffy 1972) for a more comprehensive historical account.

Although Aristotelian teleology was no longer considered a part of modern science, problems contained in it, such as "the whole is greater than the sum of its parts," and the order and goal directedness of living things, are still among the problems of today's systems research. For example, what is a "whole"? What does "the sum of its parts" mean? With different understandings, as a matter of fact, particular systems can be constructed so that the sum of its parts might be smaller than the whole (Lin and Fan 1997). These problems and other related ones have not been studied in branches of modern science, because these branches have been established on Descartes' second principle—divide each problem into parts as small as possible, and Galileo's method of simplifying the complicated process of concern into basic portions and processes (Kuhn 1962).

This superficial discussion indicates that the concept of systems we are studying today is not simply a product of yesterday. Instead, it is a reappearance of some ancient thought and a modern form of an ancient quest. This quest has been recognized in the human struggle for survival with nature, and has been studied at various points in time by using the languages of different historical moments. In 1959 Ackoff, one of the founders of operations research, commented that

> During the past 2 decades, we witnessed the appearance of the key concept of "systems" in scientific research. However, with the appearance of the concept, what changes have occurred in modern science? Under the name of "systems research," many branches of modern science have shown the trend of synthetic development; research methods and results in various disciplines have been intertwined to influence the overall research progress, so one feels the tendency of synthetic development in scientific activities. This synthetic development requires the introduction of new concepts and new thoughts in the

> entire spectrum of science. In a certain sense, all of this can be considered as the center of the concept of "systems."

One Soviet expert described the progress of modern science as follows (Hahn 1967, p. 185):

> Refining specific methods of systems research is a widespread tendency in the exploration of modern scientific knowledge, just as science in the nineteenth century with forming natural theoretical systems and progresses of science as its characteristics.

Von Bertalanffy (1972) described the scientific revolution in the sixteenth century as follows:

> The Scientific Revolution of the 16th to 17th century replaced the descriptive-metaphysical conception of the universe epitomized in Aristotle's doctrine by the mathematical-positivistic or Galilean conception. That is, the vision of the world as a teleological cosmos was replaced by the description of events in causal, mathematical laws.

Based on this description, we can describe the change in modern science and technology as follows. At the same time Descartes' second principle and Galileo's method are continuously employed, and systems methodology is introduced and established in order to deal with problems of order, structure, and organization. Why do we still utilize Descartes' second principle and Galileo's method? The answer is YES for two reasons. Firstly, they have been extremely effective in scientific research and administration, where all problems and phenomena could be decomposed into causal chains, which are then treated individually. This has been the foundation for all basic theoretical research and modern laboratory activities, leading to all the major technological advances in the recent history. Secondly, modern science and technology are not made up of Utopian projects as described by Popper (1945), reknitting every corner for a new world; instead based on the known knowledge, they are progressing in all directions with more depth, more applicability, and a higher level of sophistication. On the other hand, the world is not a pile of infinitely many isolated objects, where not every problem or phenomenon can be simply described by causal relationships. The fundamental characteristics of the physical world are its organizational structure and connections of interior and exterior relations of different matters. The study of either isolated parts or separate causalities of problems can hardly explain completely or relatively globally the surrounding world. At this junction, the research progress of the three-body problem in mechanics is an adequate example [for details see (Lin 2007) and references there]. So, as human race advances, studying problems with multi-causality or multi-relationship will become more and more significant; for details to this end, please consult with (Lin and OuYang 2010).

Let us now turn our attention to the discussion of the technological background for systems theory to appear. In particular, we will look at the need for system science to arise in the light of the advances of technology and in meeting the requirement for higher level productivity. In the technology front there has been many noted advances:

1. Energies produced by various devices, such as steam engines, motors, computers, and automatic controllers;
2. Self-controlled equipment from domestic temperature controllers to self-directed missiles;
3. The information highway, which has resulted in increased communication of new scientific results. On the other hand, increased speed of communication furthers scientific development to a different level. And,
4. New construction materials pressingly demanded by social changes.

From these examples, it can be seen that the development of technology has been forcing the mankind to consider not only a single machine or matter or phenomenon, but also systems of machines, systems of matter and phenomena, and systems of men, matter, and machines. Every time when a revolutionary industrial design is introduced, such as steam engines, automobiles, cordless equipment, and the like of the past, missiles, aircrafts, or new construction materials of the present, a collective effort, combining many different aspects of knowledge, has to be in place. The collective effort in general includes a combination of various techniques, machines, electronic technology, chemical reactions, people, etc. Here, the relationship between people and machines becomes more obvious, and uncountable financial, economic, social, and political problems are intertwined to a giant, complicated system, consisting of men, machines, and many other components. It was the great political, technical, and personnel arrangement success of the American Apollo project that it reveals the fact that the history has reached such a point that science and technology have been so maturely developed that each rational combination of different pieces of the available knowledge could result in unexpected consumable products.

Next, let us look at how the development in the arena of economies had helped stimulate the development of systems science. In particular, a great many business problems require the location of optimal point of maximum economic effect and minimum cost in an extremely complicated network. These kinds of problems not only appear in industry, agriculture, military affairs, and business, but politicians are also using similar (systems) methods to seek answers to problems such as air and water pollution, transportation blockages, decline of inner cities, teenage gangs, etc. And, in the business sector, there has been a tendency of designing and manufacturing fancier and more user-friendly products that bring in more profits.

As a matter of fact, under different interpretations, all areas of human activity have been faced with complexity, totality, and systemality. This tendency betokens a sharp change in scientific thinking. By comparing Descartes' second principle and Galileo's method with systems methodology and thinking logic, and considering the development tendency, as described previously, appearing in the world of learning and the world of business production, it is not hard to see that because of the introduction of systemic concepts, another new scientific and technological revolution is in the making. To this end, for example, each application of systems thinking points out the fact that the relevant classical theory needs to be modified somehow, see (Klir 1970). As always the case in the scientific history, not all

scientific workers had the same kind of optimistic outlook (Berlinski 1976; Lilienfeld 1978). Some scholars believed that this phenomenon is an omen that systems research itself is facing a crisis (Wood-Harper and Fitzgerald 1982). As pointed out earlier, due to the lack of an adequate language and intuition and playground, most of the promising conclusions and predictions derived earlier in systems research were ordinary language based (Berlinski 1976) so that to the scientific minds, their validities are questionable. Contrary to this situation, some recent works have shown some very significant progress in this front, for details, see (Klir 2001; Lin 2008b; Lin and OuYang 2010).

In 2001, Klir looked at the controversial phenomenon from a different angle. Because systems thinking focuses on those properties of systems and associated problems that emanate from the general notion of systemhood, while the divisions of the classical science have been done largely on properties of thinghood, systems science and research would naturally transcend all the disciplines of the classical science and becomes a force making the existing disciplinary boundaries totally irrelevant and superficial. The cross-disciplinary feature of the systems science and research implies that

1. Researches, done in systems science, can be applied to virtually all disciplines of the classical science;
2. Issues involving systemhood, studied in individual specialization of the classical science, can be studied comprehensively and thoroughly; and
3. A unifying influence on the classical science where a growing number of narrow disciplines appears is created.

Therefore, the classical and systems sciences can be viewed as a genuine 2-D science, where, as analyzed earlier, with the advantage of the newly discovered second dimension, we should be able to resolve some of the unsettled problems that have been difficult for modern science to conquer.

In the rest of this book, that is sequel to (Lin 2008b), we will show how this second dimension—the systems science—can be successfully employed to address and resolve some of the age-old problems in sociology, philosophy, and the history of business. That is, together with (Lin 2008b), we will show how the systemic yoyo model can be equally applied to natural and social sciences so that statistics can be meaningfully employed to verify local phenomena, if the adequate data can be collected.

1.2 Whole Evolution and Systemic Yoyos

From the primeval to modern civilizations, the mankind has gone through a history of over several millions of years. However, a relatively well-recorded history goes back only as far as about 3,000 years. During this time frame, the development of science mirrors that of human civilizations. And, each progress of pursuing after

the ultimate truth is a process of getting rid of the stale and taking in the fresh and of making new discoveries and new creativities. Each time when the authority was repudiated, science was reborn again. Each time when the "ultimate truth" was questioned, a scientific prosperity appeared. That is, each time when people praise authorities, they are in fact praising ignorance.

When the mankind enters the twenty first century, it faces new challenges along with age-old unsettled problems. Some of these challenges impose an urgent need to expand the boundary of science in order to address additional problems, while the age-old problems require the man to scrutinize the available science more closely. That is, along with the history turning to another new page, it is once again a golden opportunity for us to think about the limitations of and problems existing within science, which we inherited from the generations before us. Answering the call of time at the turn of a new century, with his profound insights, independent creativity, and courage, OuYang proposed the blown-up theory of nonlinear evolution problems based on a reversed thinking logic, factual evidence, and over 30 years of reasoning and practice. It is found (Lin 1998a; Wu and Lin 2002; OuYang 1994) that in terms of the formalism, nonlinear evolution models are the singularity problems of mathematical blown-ups of uneven formal evolutions; and in terms of physical objectivity, nonlinear evolution models describe mutual reactions of uneven structures of materials, which is no longer a problem of formal quantities. Since uneven structures stand for eddy sources, leading to eddy motions instead of waves, the mystery of nonlinearity, which has been bothering the mankind for over 300 years, is resolved at once both physically and mathematically. What is shown is that the essence of nonlinear evolutions is the destruction of the initial value automorphic structures and appearance of discontinuity. It provides a tool of theoretical analysis for studying objective transitional and reversal changes of materials and events.

In the early stages of the Western civilization, there existed two opposite schools on the structure of materials (Jarmov 1981; Kline 1972). One school believed that materials were made up of uncountable and invisible particles, named "atoms;" the other school that all materials were continuous. A representative of the former school is the ancient Greek philosopher Democritus (about 460–370 BC) and the later the ancient philosopher Aristotle (384–322 BC). Since abundant existence of solids made it easy for people to accept the Aristotelian continuity, the theory of "atoms" was not treated with any validity until the early part of the nineteenth century when Dalton (1766–1844) established relevant evidence. In principle, Leibniz and Newton's calculus was originated in the Aristotelian thoughts. Along with calculus, Newton constructed his laws of motion on the computational basis of calculus and accomplished the first successes in applications in celestial movements under unequal-quantitative effects. With over 200 years of development, the classical mechanics has gradually evolved into such a set of analysis methods based on continuity that even nearly a century after quantum mechanics and relativity theory were established, the thinking logic and methods developed on continuity are still in use today (Prigogine 1967; Thom 1975). Note: Considering that most readers of this volume will be from areas of

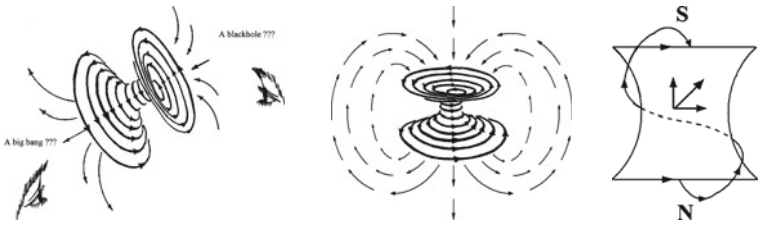

Fig. 1.1 The eddy motion model of the general system

social sciences, there is one natural concern at this junction regarding these two schools on the structure of materials because societies and individuals are not conventionally seen as material things. The key and unconventional concept we will establish in this volume is that all matters and materials, either living or nonliving, either biological or physical, in the universe are systems, each of which can be legitimately investigated as a rotational pool of fluids. More specifically, the physical world is indeed an ocean of constantly changing flows of spinning pools of fluids, for details, see Chap. 2. So, neither of the ancient schools on the structure of materials when seen as systems and in turn spinning pools of fluids has provided a comprehensive portrait for the structure of materials, be they physical objects or human organizations. It is because in the universe, as an abstract ocean of flowing spinning pools of fluids, both continuity and atomic particles are regional, local phenomena, where when isolated particles flow in a uniform direction, the sense of continuity appears if the flow is seen from a distance. And what are most common in the ocean are the interactions of rotational pools of fluids, and these interactions should be more righteously represented by chaotic discontinuities. For further deliberation, please refer to the discussion about Fig. 1.1 below in this section.

Due to differences in the environmental conditions and living circumstances, where the West was originated from castle-like environments and the East from big river cultures with agriculture and water conservation as the foundation of their national prosperities, the ancient Eastern civilizations were different from those of the West. So, naturally, Chinese people have been more observing about reversal and transitional changes of weathers and rivers. Since fluid motions are irregular and difficult to compute exactly, that was why the *Book of Changes* and *Lao Tzu* appeared in China (Wilhelm and Baynes 1967; Liang 1996; English and Feng 1972). The most important characteristic of the *Book of Changes* is its way of knowing the world through materials' images and analyzing materials' changes through figurative structures with an emphasis placed on materials' irregularities, discontinuities, transitional, and reversal changes.

As what is pointed out in the blown-up theory (Lin and OuYang 1996; Lin 1998a; Wu and Lin 2002), in terms of mathematical symbolism, due to escapes in uneven forms from continuity, the evolution of any nonlinear evolution model is no longer a problem of simply expanding the given initial values. What is

significant here is that through nonlinear evolutions, the concept of blown-ups can represent Lao Tzu's teaching that "all things are impregnated by two alternating tendencies, the tendency toward completion and the tendency toward initiation, which, acting together, complete each other" (Lao Tzu 1972; Liang 1996; English and Feng 1972), and agrees with non-initial value automorphic evolutions as what the *Book of Changes* describes: "At extremes, changes are inevitable. As soon as a change occurs, things will stabilize and stability implies long lasting" (Wilhalm and Baynes 1967).

Since nonlinearity describes eddy motions, there must be different eddy vectorities and consequent irregularities. That is, the phenomenon of orderlessness, as observed in the study of chaos theory (Lorenz 1993), is inevitable. When looking at fluid motions from the angle of eddies, one can see that the corresponding quantitative irregularities, orderlessness, multiplicities, complexities, etc., are all about the multiplicity of rotating materials. Therefore, there exist underlying reasons for the appearance of quantitative irregularities, multiplicities, and complexities. Those underlying reasons are the unevenness of time and space of the evolutionary materials' structures. For a detailed discussion on the concept of time, please consult with (Lin 2008b).

With conclusions of the blown-up theory, one can see that all eddy motions, as described with nonlinearities, are irregular. And, regularized mathematical methods become powerless in front of the challenge of solving discontinuously quantified deterministic problems of nonlinear evolution models. Additionally, one important concept studied in the blown-up theory is that of equal-quantitative effects, which describes the conclusion of quantitative analysis under quasi-equal acting forces. Although this concept was initially introduced in the study of fluid motions, it represents the fundamental and universal characteristic of materials' movements. What is important about this concept is that it reveals the fact that nonlinearities are originated from the structures of materials instead of non-structural quantities.

On the basis of the blown-up theory and the discussion on whether or not the world can be seen from the point of view of systems (Lin 1988c; Lin et al. 1990), the concepts of black holes, big bangs, and converging and diverging eddy motions are coined together in the model shown in Fig. 1.1. This model was established in (Wu and Lin 2002) for each object and every system imaginable. In particular, each system or object considered in a study is a multi-dimensional entity that spins about its invisible axis. If we fathom such a spinning entity in our 3-D space, we will have a structure as shown in Fig. 1.1a. The side of black hole sucks in all things, such as materials, information, and energy. After funneling through the short narrow neck, all things are spit out in the form of a big bang. Some of the materials, spit out from the end of big bang, never return to the other side and some will (Fig. 1.1b). For the sake of convenience of communication, such a structure, as shown in Fig. 1.1a, is called a (Chinese) yoyo due to its general shape. More specifically, what this model says is that each physical entity in the universe, be it a tangible or intangible object, a living being, an organization, a culture, a civilization, etc., can all be seen as a kind of realization of a certain multi-dimensional

spinning yoyo with an invisible spin field around it. It stays in a constant spinning motion as depicted in Fig. 1.1a. If it does stop its spinning, it will no longer exist as an identifiable system. What Fig. 1.1c shows is that due to the interactions between the eddy field, which spins perpendicular to the axis of spin, of the model, and the meridian field, which rotates parallel to axis of spin, all the materials returning to the black hole side travel along a spiral trajectory.

Before we look at the outlines of justification for this model in this introductory chapter, the details of which are presented in Part 1 of this volume, considering the main purpose of this book let us first answer natural questions that the reader might have: How and why a social system may have a structure similar to the yoyo model? Why each social entity would be spinning about an invisible axis? And what might be a black hole in a given social system?

Firstly, each social entity is an objectively existing system that is made up of objects, such as people and other physical elements, and some specific relations between the objects, where it is these relations that make the objects emerge as an organic whole, called a social system. For example, let us look at a university of high education. Without the specific setup of organizational whole (relationships), the people, the buildings, the equipments, etc., will not emerge as a university (system). Now, what the yoyo model says is that each imaginable system, which is defined as the totality of some objects and some relationships between the objects (Lin 1999), possesses the yoyo structure so that each chosen social system, as a specific system involving people, has its own specific multi-dimensional yoyo structure with a rotational field.

Secondly, there are many different ways for one to see why each social entity spins about an invisible axis. In particular, let us imagine an organization, say a business entity. As it is well-known in management science, each firm has its own particular organizational culture. Differences in organizational cultures lead to varied levels of productivity. Now, the basic components of an organizational culture change over time. These changes constitute the evolution of the firm and are caused by inventing and importing ideas from other organizations and consequently modifying or eliminating some of the existing ones. The concept of spin beneath the systemic yoyo structure of the firm comes from what ideas to invent, which external ideas to import, and which existing ones to eliminate. If idea A will likely make the firm more prosperous with higher level of productivity, while idea B will likely make the firm stay as it has been, then these ideas will form a spin in the organizational culture. Specifically, some members of the firm might like additional productivity so that their personal goals can be materialized in the process of creating the extra productivity, while some other members might like to keep things as they have been so that what they have occupied, such as income, prestige, social status, etc., will not be adversely affected. These two groups will fight against each other to push for their agendas so that theoretically, ideas A and B actually "spin" around each other. For one moment, A is ahead; for the next moment B is leading. And at yet another moment no side is ahead when the power struggle might very well return to the initial state of the affair. In this particular incidence, the abstract axis of spin is invisible because no one is willing to openly

admit his underlying purpose for pushing for a specific idea (either A or B or other ones).

Thirdly, the concept of black hole in a social organization can be seen relatively clearly, because each social organization is an input–output system, no matter whether the organization is seen materially, holistically, or spiritually. The input mechanism will be naturally the "black hole," while outputs of the organization will be the "big bang". Again, when the organization is seen from different angles, the meanings of "black hole" and "big bang" are different. But, together these different "black holes" and "big bangs" make the organization alive. Without the totality of "black holes" and that of "big bangs", no organization can be physically standing. Other than intuition, to this end the existing literature on civilizations, business entities, and individual humans readily does testify.

From the discussion here, a careful reader might have sensed the fact that in this book, we look at each human organization, be it a civilization, a business firm, or an individual person, as a whole that is made up of the physical body, its internal structure, and its interactions with the environment. The whole of this, according to the systemic yoyo model, is a high-dimensional spin field. Considering the fact that the body is the only carrier of all other (such as cultural, philosophical, spiritual, and psychological.) aspects of the organization, in theory each body of human organization is a pool of fluid realized through human sensing organs in the 3-D space. The word "fluid" here is an abstract term totalling the flows of energy, information, materials, etc., circulating within the inside of, going into, and giving off from the body. And in all published references we have searched these flows are studied widely in natural and social science using continuous functions, which in physics and mathematics mean flows of fluids and are widely known as flow functions. On the other hand, as it will be shown and concluded toward the end of Chap. 2 that the universe is a huge ocean of eddies, which changes and evolves constantly. That is, the totality of the physically existing world can be legitimately studied as fluids.

At this junction, a note will be appropriate to introduce the reader with the history of the systemic yoyo model. Even though the name for this model was officially introduced in (Lin 2007), the particular yoyo structure as given in Fig. 1.1a appeared on the front cover of the monograph (Wu and Lin 2002). The spirit of the model is spin, which has been well documented in (Lin 1998a), where the focus of attention was the discussion of Lorenz's chaos and the predictability of disastrous weather conditions. As detailed in (Lin 1998a), the realization of the inherent constant spin of general systems was initially discovered by OuYang in the 1960s when he was forced to look at how to predict major convective weather conditions. As for how OuYang successfully fulfilled his 1960s' task, the interested reader is encouraged to consult with (Lin 1998a; Wu and Lin 2002) and other works by OuYang listed at the end of this book.

The theoretical justification for such a model of general systems is the blown-up theory (see Chap. 2 for more details). It can also be seen as a practical background for the law of conservation of informational infrastructures (see Sect. 3.2 for more details). More specifically, based on empirical data, the following law of

conservation is proposed (Ren et al. 1998): For each given system, there must be a positive number a such that

$$AT \times BS \times CM \times DE = a \tag{1.1}$$

where A, B, C, and D are some constants determined by the structure and attributes of the system of concern, and T stands for the time as measured in the system, S the space occupied by the system, and M and E the total mass and energy contained in the system.

Because M (mass) and E (energy) can exchange to each other and the total of them is conserved, if the system is a closed one, Eq. 1.1 implies that when the time T evolves to a certain (large) value, the space S has to be very small. That is, in a limited space, the density of mass and energy becomes extremely high. So, an explosion (a big bang) is expected. Following the explosion, the space S starts to expand. That is, the time T starts to travel backward or to shrink. This end gives rise of the well-known model for the universe as derived from Einstein's relativity theory (Einstein 1983; Zhu 1985). In terms of systems, what this law of conservation implies is: Each system goes through such cycles as: … → expanding → shrinking → expanding → shrinking → … Now, the geometry of this model from Einstein's relativity theory is given in Fig. 1.1.

Empirically, the multi-dimensional yoyo model in Fig. 1.1 is manifested in different areas of life. For example, each human being, as we now see it, is a 3-D realization of such a spinning yoyo structure of a higher dimension. To illustrate this end, let us consider two simple and easy-to-repeat experiences. For the first one, let us imagine we go to a sport event, say a swim meet. As soon as we enter the pool area, we immediately find ourselves falling into a boiling pot of screaming and jumping spectators, cheering for their favorite swimmers competing in the pool. Now, let us pick a person standing or walking on the pool deck for whatever reason, either for her beauty or for his strange look or body posture. Magically enough, before long, the person from quite a good distance will feel our stare and she or he will be able to locate us in a very brief moment out of the reasonably sized and boiling audience. The reason for the existence of such a miracle and silent communication is because each side is a high-dimensional spinning yoyo. Even though we are separated by space and possibly by informational noise, the stare of one side on the other has directed that side's spin field of the yoyo structure into the spin field of the yoyo structure of the other side. That is the underlying mechanism for the silent communication to be established.

As our second example, let us look at the situation of human relationship. When an individual A has a good impression about another individual B, magically, individual B also has a similar and almost identical impression about A. When A does not like B and describes B as a dishonest person with various undesirable traits, it has been clinically proven in psychology that what A describes about B is exactly who A is himself (Hendrix 2001). Once again, the underlying mechanism for such a quiet and unspoken evaluation of each other is because each human being stands for a spinning yoyo and its rotational field. Our feelings about another

person are formed through the interactions of our invisible yoyo structures and their spin fields.

1.3 Main Results of This Book

This book consists of fourteen chapters divided into four parts. To make the presentation complete, the first part shows systematically how this systemic yoyo model is established by going through the relevant results of the blown-up theory, several relevant empirical justifications, and elementary properties of systemic yoyos. This part contains three chapters. In Chap. 2, we will look at the phenomena of blown-ups of mathematical models which truthfully and adequately describe the physical evolutionary situations of concern. Among other results, what is shown includes: When blown-ups appear with time, in most cases, nonlinearity implies blown-ups and the requirements for well-posedness (existence, uniqueness, and stability) do not hold true so that the thinking logic of modern science cannot be employed to resolve the relevant problems involving nonlinearity. By introducing an implicit transformation between a Euclidean space and a curvature space, blown-ups in the Euclidean space are found to be some transitional changes in the curvature space, illustrating a method on how to resolve the problems of the quantitative ∞, numerical instability, and computational spills, by reconsidering the situations in curvature spaces. Additionally, it is concluded that the physical characteristics of blown-ups are spinning currents. By looking at the general dynamic system, Newton's second law of motion actually indicates that as long as the acting and reacting objects have uneven structures, their mutual reaction will be nonlinear and a rotational movement, establishing the theoretical background for rotations to be the common form of movements in the universe.

In Chap. 3, by making use of the Bjerknes's Circulation Theorem, it is found that any force acting on a fluid must be a twisting force so that fluid rotations are created. This theorem explains why the mostly seen form of motion in the universe is rotation so that there must be matters and phenomena theories developed on the assumption of smoothness cannot explain. Next, the law of conservation of informational infrastructure is introduced to evidence the physical existence of systemic yoyo structures behind various organizations and structures. This chapter is concluded with two easily repeatable observations in social settings. In Chap. 4, after introducing the structure of meridian fields of yoyo structures, the quark structure of systemic yoyos is established. As applications, a plausible explanation for how and why throughout the history, geomagnetic poles of the Earth have reversed their directions numerous times. By focusing on interactions of systemic yoyos, it is found that yoyo fields possess such similar properties as the magnetic fields that like fields repulse and opposite polarities attract, leading to a generalization of Lenz' Law. Then generalizing Newton's laws of motion, four laws on state of motion of general materials are provided.

The second part looks at the systemic structure behind civilizations by considering the state and interactions of and turmoil within civilizations. This part contains three chapters. In Chap. 5, we will study the concept and the internal structure of civilizations and reveal the mechanism underlying the many inexplicable phenomena that have been observed in social organizations and human history from the angle of the systemic yoyo model in order to provide both novel and practically useful explanations. Among other results, it is shown that each social entity evolves through stages of expansion and contraction alternately and at each transition the entity goes through a blown-up and that civilizations situated in lands with unevenly distributed natural resources tend to have higher degrees of unity than others; and the latter ones tend to have multiple centers. In Chap. 6, the general thinking logic and methodology of the systemic yoyo model is applied to provide novel resolutions for some of the very important questions studied in the research of history and civilizations regarding the interactions between civilizations. Among other results, it is shown that the appearance of the global identity crisis in the 1990s is an indicator for the United States to cease its global dominance as the sole superpower, that to separate one civilization from another, one only needs to look at the natural environment and geographic conditions in which people live, and that when outside forces, which try to act upon a specific country, were relatively weak, the rulers of the country would like to cut off the cultural connections from within the country with the outside world. By doing so, these rulers could potential strengthen their control of the country. However, as a consequence of doing so, the originally great and prosperous culture will face its dismay by going through a transitional change (blown-up). That will be when the society has to open up itself once again to accept useful and beneficial elements from other powerful and prospering civilizations. Chapter 7 studies the peace and harmony between civilizations, and chaos experienced by civilizations, how economic prosperities travel, and how Westernization and modernization are related. Among other conclusions, it is shown that a world class war is very likely to occur between the rich nations and those that are not really poor but feel strongly and convincingly that they have been relatively deprived their rights and prosperity, that those multiculturalists in the United States are helping to make America a new civilization, developed on the strengths of other civilizations naturally brought over by migrants, and that to bring prosperity to a specific region, one necessary condition is that only when the region's yoyo structure contains a convergent spin field, the region has the potential to bring about prosperity.

The third part contains three chapters with investigations of the systemic structure beneath business organizations by looking at economic yoyos, their dynamic equilibrium, and the dynamics of small and large projects. In Chap. 8, it is shown that in a market of free competition, demand and supply are about how different economic forces mutually restrict each other and mutually react on each other. So, when calculus-based mathematics is employed to the study of these concepts, one has to face nonlinearity. This of course lays down the theoretical foundation for introducing the systemic yoyo model and its methodology into the

research of economic entities, organizations, relationships, and evolutions. Next, the yoyo model is applied to model the evolution of competitions between economic sectors and individual enterprises from the moment when a sector or an enterprise is born to the time when it is gone; and five case studies are utilized to demonstrate the various stages of evolution existing in the general development of economic sectors or business enterprises. In Chap. 9, by modeling each commercial firm as a specific, abstract spinning yoyo, we employ figurative analysis to show how small economic entities could be inevitably bullied and destroyed by business empires. Then a traditional calculus-based profit-maximization model is established to study large and small firms and their difference in areas of production, determination of product selling prices, and the cost basis of their products. Among what is found include that when a firm has limited resources, its business has a glass ceiling for its potential maximum level of profits, while such a ceiling does not exist for firms that have unlimited financial resources, and that the availability of financial resources determines how small firms might manage their day-to-day operations and how few other related resources are available to them. Then all the important conclusions are empirically checked using several thought-provoking case studies. In Chap. 10, we investigate using analytic methods the roles of small and large projects in the development and evolution of a commercial company and why companies with a history of taking on large projects tend to eventually fail with large projects. The analytic models are established to (1) describe investors' behaviors; (2) depict the dynamics between CEOs and their boards of directors; and (3) reveal how profit ceilings exist for large projects. Among other results, it is shown that the higher the level the CEO's initial ability is, the more likely he would initiate and manage small projects, and the more labor effort, he will devote to these projects, that the CEO's additional effort spent on the small projects helps him gain non-pecuniary benefits, which he can use to gain additional bargaining power over the board, and that for small projects, the profit potential for the company is unlimited. Then, three specific case studies from the current emerging Chinese economy are considered using the theoretical conclusions derived in this chapter.

The last part of this book studies the systemic structure of the human mind by first arguing that both nature and man are systems with their respective spinning yoyo structures. Then the four human endowments—self-awareness, imagination, conscience, and free will—are considered along with character, thought, desire, enthusiasm, happiness, fear, and the value of forced struggle. In particular, Chap. 11 shows that human bodies are systems; the nature is also a system, consisting of many other systems, including humans, by looking at the traditional Chinese medicine, the classic, named Tao Te Ching, and the systemic yoyo model as the foundation of reasoning. In Chap. 12, new insights are given to address what the four human endowments are and some of the very important questions related to these human endowments. Among many interesting results, it is found that

1. When the systemic structure of a person is uneven with its component materials, his yoyo structure will more likely spin on its own, and that the more

uneven the yoyo structure is, the more driven, or more self-motivated, or more self-determined the person will be. That is, instead of being innate, self-motivation and self-determination are functions defined by hardships and knowledge of the opposite possibilities.
2. When a person suffers from an adversity, a failure, or made a mistake, he experiences one of the following situations: facing great resistance, being completely stopped temporarily, or having taken a regretful choice. If a person is able to tap deeply into his imagination, then he can find out how to avoid the same situation from happening in the future and/or how to take advantage of similar situations in the future.
3. Conscience does not stand for the reason that addresses whether right or wrong.
4. Using the commonly accepted definition of rational agents, it is shown that in terms of whole evolutions, no human being or firm can be rational due to limitations in its knowledge and the development of technology, and that in the physical reality, there does not exist such a thing as freedom in absolute terms.

Chapter 13 is devoted to the discussion of character, thought, desire, and enthusiasm on a unified theoretical foundation in order to establish tangible results that can be potentially useful in practice. Among other results, it is shown that by using self-awareness, one develops his imagination along with his upbringing; utilizing free will, he experiments ways to interact with external systems. Whatever the consequences, the experiments and their outcomes are stored in the reservoir of his imagination. Pressured by external fields, he adopts optimal patterns for his underlying field structure to achieve the best possible balance in its interaction with specific circumstances and to deal with different yoyo structures. As the person matures over time, his ways of handling often-seen situations (external yoyo fields) are repeatedly applied, leading to the same or similar outcomes. That is, if no new-event happens, one is expected to have a relatively stable system of traits, consisting of his optimal patterns of field flow and field interactions, that specifies how he would relate and react to others, to known kinds of stimuli, and the often-seen external field structures of the environment. This relatively stable system of traits is the character of the person. Personality is the subsystem of one's character that consists of all the 3-D realizations of his optimal patterns of field flow and field interactions that show how he related and reacted to others, to various stimuli, and to the environment. Enthusiasm is a state of intensive spin of the underlying yoyo field of one's mind and body that has a specific tilt in the axis of rotation.

Also, it is shown that each thought is a local eddy in the reservoir of someone's imagination, which explains why new thought generally is triggered by some hint from the outside world. Each thinking process is a process of utilizing the hint to generate a local eddy in the reservoir of imagination by pulling relevant information and knowledge together to form an organic whole. In terms of desire, it is how one wants his underlying yoyo structure to be in terms of one of or any combination of its attributes: direction, orientation, spin intensity, and scale. With self-awareness, he senses how his yoyo field could be potentially made uniform so

that it does not have to be as it is. That is, desire comes from and is created by the differences naturally existing between human yoyo fields. For the relationship between desire and fear, other than they share the same brain circuit, it is found that they are really the different sides of the same coin. Desire describes what one wants for his yoyo structure, while fear how one does not want to lose what he already has within his field. For the investigation of enthusiasm, among other interesting results, it is shown that there are two ways for a field that spins in its inertial state to suddenly acquire the momentum to rotate at a higher level of intensity: a new unevenness in the structure of the field suddenly appears, or an ever-presenting field of the environment suddenly, unexpectedly disappears. In terms of suddenly causing new structural unevenness, one can simply discover either new strengths in himself or new patterns of interaction with other fields. When the field of increased intensity is realized in the 3-D space, it makes people feel that his enthusiasm has inspired and aroused him to put action into the task at hand. And this realization makes the person himself feel that his enthusiasm makes originally monotonous works more enjoyable to finish. If a person can keep his underlying field spin at its newly acquired momentum and intensity, all the other field structures, which used to resist the change in the person, will have to change their forms of motion accordingly in an accommodating way. That is why before long all the obstacles that now stand in the way will melt away, and he will find himself in possession of power that he can change behaviors of others according to his likings.

Chapter 14 explores the systemic mechanisms underlying the concepts of happiness, fear, and self-confidence, and the advantages and values of forced labor, the structure of the mind, and the human nature. Among many important results, here are some examples. When a person feels happy, it means that at that moment his underlying yoyo field just achieved an upper hand over a resistance in its movement against some other field flows in its environment. So, for a person to have a happy life, it literally means that throughout his life, he experiences victorious moments one after another. And, one way for a person to live a life of enduring happiness is to have such a definite goal that its realization is not very well defined so that he can only feel the gradual realization of the goal without any specific means to check on the progress. Self-confidence is closely related to one's ability of making predictions in his free will and in most cases there is a definite way to develop self-confidence in any person of average intelligence. And, both ambition and self-confidence are fundamentally determined by the degree of unevenness in the internal structure of the person. Any forced struggle in life is equivalent to the situation that an ever-presenting field of the environment suddenly, unexpectedly disappears so that one has to fill the vacuum left behind by the departed field. Any person who has a complete grip over his own thoughts possesses such an ability that he can maneuver over the form and movement of his thought pools in his imagination. In this case, the person will be able to create a new pattern of flow to offset any local blockage appearing in the originally spinning field. And if his internal yoyo structure is extremely uneven, then his field will be rotating on its own with a high level of intensity and most regional

blockages will not create any trouble for him at all because his field will simply push the blockages along without any need to alter its pattern of flow.

When seeing one's own field floating in a rough sea of eddy pools of the universe, it becomes obvious that however, a yoyo spins, it creates some sorts of conflicts with spinning yoyos it comes in contact with. In its interactions with others, one inevitably has to experience self-doubt or skepticism about his established goal and the potential of his eventual attainment. This explains why skepticism has been known as the deadly enemy of progress and self-development and why the development of self-confidence and enthusiasm starts with the elimination of different forms of fear. If one desires to make a significant change in his life, he has to change the pattern of his underlying field's motion. All forms of life are born out of the interaction of two large-scale spinning yoyos. As the parental yoyo structures gradually deteriorate, the subeddies become independent. For one to survive the intense competition of various relationships, he has to center himself on the laws that govern the basic operations of spinning yoyos. For him to achieve a leadership position in the flow of eddy pools, he must comply with the laws that govern growth, development, and success. To reach the ultimate state of happiness, one has to rely on the natural laws that govern how systemic yoyos operate and the laws that govern the attainment of success.

As the conclusion of this chapter, let us remind the reader that the theory presented in this volume is entirely based on a comprehensive understanding of the concept of (general) systems. As shown earlier, this concept has been investigated in different ways using various languages throughout the recorded history. However, like the concept of Tao (English and Feng 1972; Lao Tzu time unknown; unknown), whenever the concept of systems is defined in a specific fashion, what is described is not exactly the concept, see Sect. 3.2 for more details. This fact means that each specific technical definition of systems only captures a particular aspect of the desired concept of systems. So, to achieve the desired level of understanding, one needs to combine several available versions of the concept in order to achieve the required mastery. For our purpose in this volume, the listed versions of definition of systems in this chapter and those in Sect. 3.2 will be adequate.

Along with the convention, established in Chap. 2, that all systems, be they physical objects or organizations of biological beings, can be investigated as rotational pools of fluids together with a deep understanding of the concept of systems, the rest of the theory presented in the following chapters becomes quite intuitive and straightforward developed on the sound scientific means of analytic analysis, laboratory experiments, and formal logic reasoning. To this end, some readers might prefer to lay the theory on a more thorough analysis of human phenomena themselves. If you are one of such readers, we can fully understand for several reasons. Firstly, our theory is presented in a relatively (natural) scientific fashion due to our professional backgrounds in mathematics and technology. After a conclusion is validated, it is employed throughout the rest of the theory without repeatedly explaining why the conclusion once again employed is correct. Secondly, our stance is that if reliable thorough analysis of human phenomena already

existed, why do we still have trouble explaining many organizational behaviors and events, such as the current financial crisis? To us and most of all colleagues we have talked to, the answer is quite simple: as of this writing, there is no reliable thorough analysis of human phenomena especially those developed for large-scale ones (for supporting evidence, please refer to the references listed in the fourth part of this book). Thirdly, if you feel that without enough reliable information, it is impossible to know if these human phenomena conform or not to the yoyo model, the truth of the matter is that in the scientific history if a model is shown to hold true under certain conditions, then as long as a phenomenon, be it physical or human, satisfies all the listed conditions, it will definitely fit the model or the model applies to the phenomenon. In particular to our present situation, as long as we are convinced that the human phenomena considered herein are systems, then they can be seen and modeled by the yoyo model without any slightest doubt. As for the reliability of information, it has been shown in practice (Soros 1998) and theory (Liu and Lin 2006) that the more reliable a piece of information is the more chaotic situation it creates. That is, reliability is only relative instead of being absolute. Fourthly, could this study be secondary developed based on the existing scientific literature? The answer to this question is both yes and no. It is yes because many parts of our theory dig deeply into the existing social scientific literature and try to address whys for those facts seen as granted in the literature. In this sense, our work here in fact should not be treated as secondary to what has already existed. The answer is no because from our reasonably intensive search of the available literature, it is found that most of the relevant publications are generated on the bases of either ordinary language presentation without much scientific rigor, or based on some simple tabulations of statistics, or some reasonably sophisticated statistics. When statistics are employed, discrete variables are generally treated as continuous with one sentence announcement without any justification for the validity of doing so in the spirit like, "in order to take advantage of the available tools of mathematics, we assume these variables are continuous and differentiable as many time as needed." In this sense, our theory in this volume should be seen as more fundamental and lays the theoretical foundation for achieving sound understanding of various large-scale human organizations.

Part I
Theoretical and Empirical Foundations

Chapter 2
Characteristics of Whole Evolutions

After introducing the brief history of the concept of systems and the systemic yoyo model in the previous chapter, we now in this chapter look at the theoretical foundation on why such an intuitive model of general systems holds for each and every system that is either tangible or imaginable.

2.1 Blown-Ups: Moments of Transition in Evolutions

When we study nature and treat everything we see as a system (Klir 2001), then one fact we can easily see is that many systems in nature evolve in concert. When one thing changes, many other seemingly unrelated things alter their states of existence accordingly. If we attempt to make predictions regarding an evolving event, such as the price of a stock in the financial markets, where the market behavior is dependent on the behaviors of the market participants, or what is forthcoming in the weather system, where nature goes through its normal course of evolution without being affected by how we think it would come out to be, we may very well find ourselves in a situation that is somewhere in between whereby we do not have enough information or we have too much information. It has been shown (Soros 2003; Liu and Lin 2006; Lorenz 1993) that no matter which situation we are in, too much information or too little, we face with uncertainties. That is why we propose (OuYang et al. 2009) to look at the evolution of the system or event whose future outlook we need to predict as a whole. That is, when developments and changes naturally existing in the natural environment are seen as a whole, we have the concept of whole evolutions. And, in whole evolutions, other than continuities, also studied in modern mathematics and science, what seems to be more important and more common is discontinuity, with which transitional changes (or blown-ups) occur. These blown-ups reflect not only the singular transitional characteristics of the whole evolutions of nonlinear equations, but also the changes in old structures being replaced by new structures.

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Thousands of case studies have shown the fact (Lin 2008b) that reversal and transitional changes are the central issue and an extremely difficult open problem of prediction science, since the well-developed method of linearity, which tries to extend the past rise-and-fall into the future, does not have the ability to predict forthcoming transitional changes and what will occur after the changes. In terms of nonlinear evolution models, blown-ups reflect destructions of old structures and establishments of new ones. Although studies of these nonlinear models reveal the limits and weaknesses of calculus-based theories, we can still make use of their analytic forms to describe to a certain degree the realisticity of discontinuous transitional changes of objective events and materials. So, the concept of blown-ups is not purely mathematical; it is also realistic. By borrowing the form of calculus, we can write the concept of blown-ups as follows: For a given (mathematical or symbolic) model that truthfully describes the physical situation of our concern, if its solution $u = u(t; t_0, u_0)$, where t stands for time and u_0 the initial state of the system, satisfies

$$\lim_{t \to t_0} |u| = +\infty, \tag{2.1}$$

and at the same time moment when $t \to t_0$, the underlying physical system also goes through a transitional change, then the solution $u = u(t; t_0, u_0)$ is called a blown-up solution and the relevant physical movement expresses a blown-up. Our analysis of thousands of real-life cases of various evolutionary systems (Lin 2008b) indicate that disastrous events appear at the moments of blown-ups in the whole evolutions of systems.

For nonlinear models in independent variables of time (t) and space (x, x, and y, or x, y, and z), the concept of blown-ups is defined similarly, where blow-ups in the model and the underlying physical system can appear in time or in space or in both. For instance, if the time–space evolution equation is written as follows:

$$\partial_t u = g(t, u, \partial_x u), \tag{2.2}$$

where u is an $n \times 1$ matrix of the state variables, $g(t, u, \partial_x u)$ an $n \times 1$ matrix of functions in t, u, and $\partial_x u$, ∂ and ∂_t stand for the differential operations $\dfrac{\partial}{\partial x}$ and $\dfrac{\partial}{\partial t}$, respectively. Assume that the initial (or boundary) condition is

$$u(t_0, x) = u_0(x). \tag{2.3}$$

Then, when the solution $u = u(t, x; t_0, u_0)$ or $u_x = u_x(t, x; t_0, u_0)$ changes, for $t \in [t_0, t_b)$, continuously, and when $t \to t_b$, the following holds true

$$\lim_{t \to t_0} |u| = +\infty, \tag{2.4}$$

or

$$\lim_{t \to t_0} |u_x| = +\infty, \tag{2.5}$$

then either u or u_x is called a blown-up solution, if the boundary value problem, consisting of Eqs. 2.2 and 2.3, truly describes a physical system and at the time

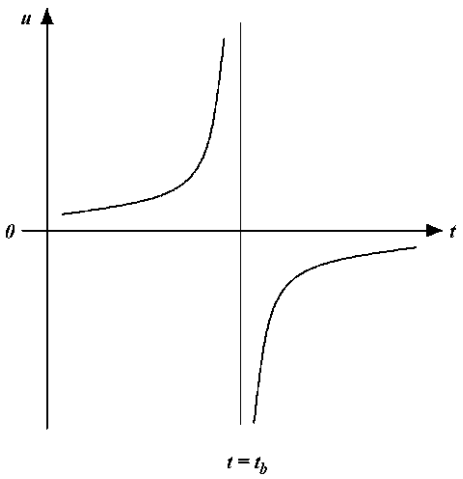

Fig. 2.1 A transitional blown-up

moment $t = t_b$, this physical system goes through a transitional change. In the rest of this chapter, we assume that this assumption holds true.

Based on the evolutionary behaviors of the physical system before and after the transition, we can classify blown-ups into two categories: transitional and non-transitional blown-ups. A blown-up is transitional, if the development of the physical system after the special blow-up moment in time or space is completely opposite to that before the blow-up. For example, if the evolution of the system grows drastically before the blow-up and the development of the system after the blow-up starts from nearly ground "zero," then such blown-up is transitional (Fig. 2.1). Otherwise, it is called non-transitional (Fig. 2.2).

2.2 Mathematical Properties of Blown-Ups

To help us understand the mathematical characteristics of blown-ups, let us look at the following constant-coefficient equation:

$$\dot{u} = a_0 + a_1 u + \ldots + a_{n-1} u^{n-1} + u^n = F, \tag{2.6}$$

where u is the state variable, and a_0, a_1, …, a_{n-1} are constants.

2.2.1 Blown-Up Properties of Quadratic Nonlinear Models

When $n = 2$, Eq. 2.6 becomes

$$\dot{u} = a_0 + a_1 u + u^2, \tag{2.7}$$

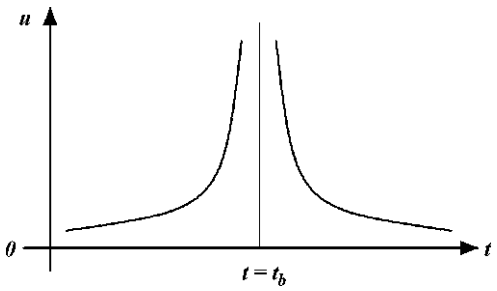

Fig. 2.2 A non-transitional blown-up

which is one of the simplest general nonlinear evolution models and is also a special Riccati equation [for all omitted technical details in this chapter, please consult with (Wu and Lin 2002)]. This equation has found a wide range of applications in the prediction science. Let us now first discuss this equation's properties of blown-ups, which are important in terms of both theoretical and practical implications. Here, we will not apply Riccati variable transformations to solve Eq. 2.7. Instead, we will present our analysis with different values of a_0 and a_1.

1. When $\Delta = a_1^2 - 4a_0 = 0$, Eq. 2.7 becomes

$$\dot{u} = \left(u + \frac{1}{2}a_1\right)^2. \tag{2.8}$$

Now, integrating by separating variables produces

$$u = -\frac{1}{2}a_1 - (A_0 + t)^{-1} \tag{2.9}$$

where A_0 is the integrating constant, determined by the given initial value. Evidently, the solution Eq. 2.9 contains a blown-up. To this end, let us analyze the details as follows.

(a) If $A_0 > 0$, then u gradually stabilizes at the equilibrium state $-\frac{1}{2}a_1$as time t approaches $+\infty$. So, in the interval $t \in [0, +\infty)$, the evolution of u is continuous.

(b) If $A_0 < 0$, then when $t \to t_0 = \text{-}A_0$, the state $u \to +\infty$. At this moment, u experiences a discontinuous singularity and a transitional change after the singularity. This kind of discontinuity has nothing to do with the smoothness of the given initial field, showing the essential characteristics of nonlinear evolutions. See Fig. 2.3.

2. When $\Delta = a_1^2 - 4a_0 > 0$, Eq. 2.7 becomes

$$\dot{u} = \left(u + \frac{1}{2}a_1\right)^2 - \frac{1}{4}\left(a_1^2 - 4a_0\right). \tag{2.10}$$

By separating the variables and integrating the previous equation, we obtain

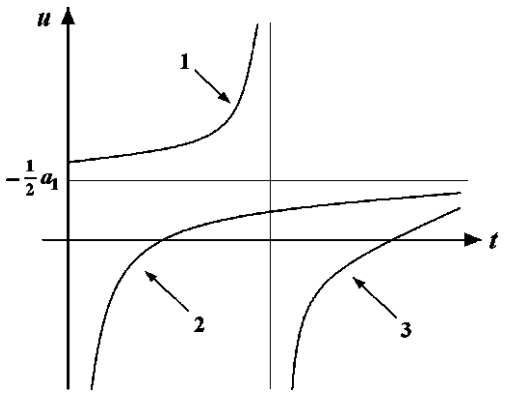

Fig. 2.3 Curve #2 stands for the integral curve when $A_0 > 0$, while curves #1 and #3 for $A_0 < 0$, where the u-axis is located at $t = -A_0$

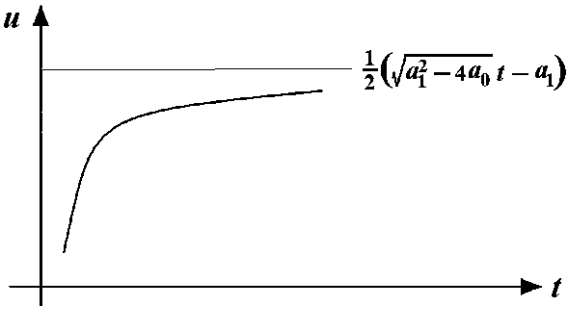

Fig. 2.4 Continuous evolution without experiencing any blown-up for the case $a_1 < 0$

$$\ln\left|\frac{u+\frac{1}{2}a_1-\frac{1}{2}\sqrt{a_1^2-4a_0}}{u+\frac{1}{2}a_1+\frac{1}{2}\sqrt{a_1^2-4a_0}}\right| = \sqrt{a_1^2-4a_0}\,t + A_0, \tag{2.11}$$

where A_0 is the integration constant. For this scenario, we can analyze the blown-up situation as follows.

(a) If the movement of our interest is limited to $\left|u+\frac{1}{2}a_1\right| < \frac{1}{2}\sqrt{a_1^2-4a_0}$, which is a bounded movement, then the solution of Eq. 2.10 is given as follows:

$$u = \frac{1}{2}\sqrt{a_1^2-4a_0}\tanh\left(\frac{1}{2}\sqrt{a_1^2-4a_0}\,t+\frac{1}{2}A_0\right)-\frac{1}{2}a_1. \tag{2.12}$$

In this case, the development of the evolution is continuous without experiencing any blown-up, Fig. 2.4.

(b) If the range of movement satisfies $\left|u+\frac{1}{2}a_1\right| > \frac{1}{2}\sqrt{a_1^2-4a_0}$, which stands for a bounded motion, then we have

$$u = \frac{1}{2}\sqrt{a_1^2-4a_0}\coth\left(-\frac{1}{2}\sqrt{a_1^2-4a_0}\,t-\frac{1}{2}A_0\right)-\frac{1}{2}a_1. \tag{2.13}$$

If $A_0 < 0$ and when

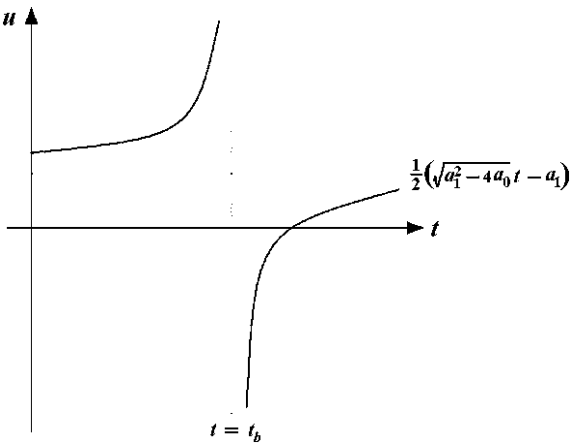

Fig. 2.5 A blown-up solution for the case of $a_1 < 0$

$$t \to t_b = -\frac{A_0}{\sqrt{a_1^2 - 4a_0}}, \tag{2.14}$$

the solution in Eq. 2.13 experiences a blown-up, Fig. 2.5. What is analyzed indicates that under a fixed set of conditions, whether or not a model experiences discontinuities is dependent on the given initial field. So, it is difficult for numerical solutions of nonlinear evolution equations to be bounded in each iteration step, no matter which smoothing scheme is employed. In this sense, it can be said that various integration schemes, designed to solve nonlinear evolution equations, cannot really avoid experiencing "explosive" growth or being trapped in "error-value spiral" computations due to the evolutionary singularities. This is where many of the paradoxes and "fascinating" conclusions in the Lorenz's chaos theory are originated.

3. When $\Delta = a_1^2 - 4a_0 < 0$, Eq. 2.7 becomes

$$\dot{u} = \left(u + \frac{1}{2}a_1\right)^2 + \frac{1}{4}\left(4a_0 - a_1^2\right). \tag{2.15}$$

Integrating this equation provides the following:

$$u = \frac{1}{2}\sqrt{4a_0 - a_1^2}\tan\left(\frac{1}{2}\sqrt{4a_0 - a_1^2}t + A_0\right) - \frac{1}{2}a_1. \tag{2.16}$$

When

$$t \to t_b = \frac{2}{\sqrt{4a_0 - a_1^2}}\left(\frac{\pi}{2} + n\pi - A_0\right),$$

Eq. 2.16 contains periodic transitional blown-ups.

From this detailed analysis it can be seen that under different conditions, the solution of the same nonlinear model can either be continuous and smooth or experience either blown-ups or periodic transitional blown-ups. So, even for the simplest nonlinear evolution equations, the well-posedness of their evolutions in terms of differential mathematics is conditional. Here, the requirements for well-posedness are: the solution exists; it is unique, and stable (or continuous and differentiable).

A side note: please be aware that the condition of well-posedness is very important for the majority of the applied mathematics to work.

2.2.2 *Blown-Up Properties of the Cubic and* nth *Degree Polynomial Models*

When $n = 3$, other than the situation that $F = 0$ has two real solutions, one of which is of multiplicity 2, Eq. 2.6 experiences blown-ups. For details, please consult with (Wu and Lin 2002). For the general case n, even though the analytical solution of Eq. 2.6 cannot be found exactly, the blown-up properties of the solution can still be studied through qualitative means. To this end, based on the fundamental theorem of algebra, let us assume that Eq. 2.6 can be written as

$$\dot{u} = F = (u - u_1)^{p_1} \ldots (u - u_r)^{p_r} \left(u^2 + b_1 u + c_1\right)^{q_1} \ldots \left(u^2 + b_m u + c_m\right)^{q_m}, \quad (2.17)$$

where p_i and q_j, $i = 1, 2, \ldots, r$ and $j = 1, 2, \ldots, m$, are positive whole numbers, and $n = \sum_{i=1}^{r} p_i + 2\sum_{j=1}^{m} q_j$, $\Delta = b_j^2 - 4c_j < 0$, $j = 1, 2, \ldots, m$. Without loss of generality, assume that $u_1 \geq u_2 \geq \ldots \geq u_r$, then the blown-up properties of the solution of Eq. 2.17 are given in the following theorem.

Theorem 2.1 The condition under which the solution of an initial value problem of Eq. 2.3 contains blown-ups is given by

1. When u_i, $i = 1, 2, \ldots, r$, does not exist, that is, $F = 0$ does not have any real solution; and
2. If $F = 0$ does have real solutions u_i, $i = 1, 2, \ldots, r$, satisfying $u_1 \geq u_2 \geq \ldots \geq u_r$,
   (a) When n is an even number, if $u > u_1$, then u contains blow-up(s);
   (b) When n is an odd number, no matter whether $u > u_1$ or $u < u_r$, there always exist blown-ups.

A detailed proof of this theorem can be found in (Wu and Lin 2002, pp. 65–66) and is omitted here.

For higher order nonlinear evolution systems, in general, each of them can be simplified into systems of nonlinear evolution equations in a form similar to that of Eq. 2.6. Since the general case is difficult to analyze, let us look at the following second order nonlinear evolution equation:

$$\ddot{u} = a_0 + a_1 u + a_2 u^2 + u^3, \tag{2.18}$$

where $\ddot{u} = \dfrac{\mathrm{d}^2 u}{\mathrm{d}t^2}$ and a_i $(i = 0,\ 1,\ 2)$ are constants. Now, this equation can be reduced to the following system of first order equations in two variables:

$$\begin{cases} \dot{u} = v \\ \dot{v} = a_0 + a_1 u + a_2 u^2 + u^3 \end{cases}. \tag{2.19}$$

Multiplying the left-hand side of the second equation by v and the right-hand side by u and then integrating the resultant equation provides the following:

$$v^2 = E = 2\left(\frac{1}{4}u^4 + \frac{1}{3}a_2 u^3 + \frac{1}{2}a_1 u^2 + a_0 u + h_0\right), \tag{2.20}$$

where h_0 is the integration constant. Now, the system in Eq. 2.20 can be reduced into

$$\dot{u} = \pm\sqrt{E}. \tag{2.21}$$

Now, we study the blown-up properties of Eq. 2.21 as follows.

1. If $E = 0$ has a real solution of multiplicity four, then based on Eq. 2.8, it can be shown that u contains blown-ups.
2. If $E = 0$ contains two distinct real solutions of multiplicity two, then $E = \dfrac{1}{4}\left(u^2 + b_1 u + c_1\right)^2$ and $b_1^2 - 4c_1 \neq 0$. Now, the analysis is done in two cases:
   (a) When $b_1^2 - 4c_1 > 0$, based on Eq. 2.10 it follows that u contains a continuous bounded solution and a blown-up solution.
   (b) When $b_1^2 - 4c_1 < 0$, based on Eq. 2.14 it follows that u contains both a periodic blown-up solution.
3. If $E = 0$ contains only one real solution, which has multiplicity two, and two conjugate complex solutions, then $E = u^2(u^2 + b_2 u + c_2)$, where we assumed that the real solution of multiplicity two is zero, and $b_2^2 - 4c_2 < 0$. In this case, Eq. 2.21 becomes

$$\dot{u} = \pm u\sqrt{u^2 + b_2 u + c_2}. \tag{2.22}$$

Let $u = \dfrac{1}{v}$. Then the previous equation can be reduced into

$$\frac{\mathrm{d}v}{\sqrt{C_2\left(v + \dfrac{b_2}{2c_2}\right)^2 + \dfrac{4c_2 - b_2^2}{4c_2}}} = \pm \mathrm{d}t. \tag{2.23}$$

Now, let us analyze the scenario in two cases.

(a) When $c_2 < 0$, we have $b_2^2 - 4c_2 < 0$ and an integration of Eq. 2.23 can produce

$$-\arcsin\frac{v+\dfrac{b2}{2c2}}{\sqrt{\dfrac{b_2^2-4c_2}{4c_2}}} = \sqrt{-c_2}(\pm t + A_0), \tag{2.24}$$

where A_0 is a constant. When t takes on a certain special value, $v = 0$ and $u = \frac{1}{v} \to \infty$. So, the solution of Eq. 2.22 experiences blown-ups.

(b) When $c_2 > 0$ and either $b_2^2 - 4c_2 > 0$ or $b_2^2 - 4c_2 < 0$, integrating Eq. 2.23 provides

$$-\ln\left[\sqrt{c_2}\left(v+\frac{b_2}{2c_2}\right)+\sqrt{c2\left(v+\frac{b_2}{2c_2}\right)^2+\frac{4c_2-b_2^2}{4c_2}}\right] = \sqrt{c_2}(\pm t + A_0). \tag{2.25}$$

which evidently contains blown-ups.

4. If $E = 0$ has four distinct real solutions, let us assume $u_1 > u_2 > u_3 > u_4$, then Eq. 2.21 becomes

$$\dot{u} = \pm\sqrt{(u-u_1)(u-u_2)(u-u_3)(u-u_4)}. \tag{2.26}$$

So, the continuous bounded movements of Eq. 2.26 can be written by using an elliptic function. As for the unbounded movement, we will have to apply the method of estimation to prove that it contains blown-ups. As a matter of fact, when $u > u_1$ and take the "+" on the right hand side of Eq. 2.26, we can obtain the following estimate:

$$\dot{u} \geq (u-u_1)^2. \tag{2.27}$$

It is not hard to prove that in this case, u contains blown-ups. Similarly, it can be shown that when $u < u_4$, u also contains blown-ups.

Example 2.2.1 To see how the previous procedure actually works out, let us look at the following example of the nonlinear elasticity model

$$\ddot{X} = -fX + X^3, \tag{2.28}$$

where X stands for displacement of position, f the linear elasticity coefficient. As what was done to Eq. 2.18, we have

$$E^2 = \dot{X}^2 = \frac{1}{4}X^4 - \frac{1}{2}fX^2 + h_0. \tag{2.29}$$

Now, Eq. 2.28 can be reduced to the following first order nonlinear evolution equation

$$\dot{X} = \pm\sqrt{E}. \tag{2.30}$$

Our earlier discussion indicates that under certain conditions, the evolution of X contains blown-ups. Therefore, the nonlinear elasticity change is fundamentally different from that of linear elasticity change. That is, within the range of elasticity, linear elasticity models evolve continuously and smoothly. And, the evolution of nonlinear elasticity models contains discontinuous singular blown-ups.

2.2.3 *Blown-Up Properties of Nonlinear Time–Space Evolution Equations*

As for evolution equations involving changes in space, they can directly and intuitively reflect the physical meanings of blown-ups. The one-dimensional advection equation is one of the simplest nonlinear evolution equations involving changes in space. Its Cauchy problem can be written as follows:

$$\begin{cases} u_t + uu_x = 0 \\ u|_{t=0} = u_0 \end{cases}, \tag{2.31}$$

where u stands for the speed of a flow, $u_t = \dfrac{\partial u}{\partial t}$ and $u_x = \dfrac{\partial u}{\partial x}$ with t representing time and x the one-dimensional spatial location. By using the method of separating variables without expansion, we let

$$u = A(t)v(x) \text{ and } u_0(x) = A(0)v(x). \tag{2.32}$$

So, Eq. 2.31 can be reduced to the following:

$$\frac{\dot{A}}{A^2} = -v_x = -\lambda, \tag{2.33}$$

where λ is a constant. Then we have

$$\dot{A} + \lambda A^2 = 0 \text{ and } v_x = \lambda. \tag{2.34}$$

Integrating Eq. 2.34 by separating the variables and taking $A(0) = A_0$ provides

$$A = \frac{A_0}{1 + A_0 v_x t}. \tag{2.35}$$

Multiplying both sides of this equation by u_x and taking $u_{0x} = = A_0 v_x$ produces

$$u_x = \frac{u_{0x}}{1 + u_{0x}t}. \tag{2.36}$$

Based on the definition of the degree of divergence, u_x is the first-dimensional degree of divergence. When $u_{0x} > 0$, that is when the initial field is divergent, u_x declines continuously with time t until the diverging motion disappears. If $u_{0x} < 0$, that is when the initial field is convergent, then the solution of $u_x \to \infty$ and experiences a discontinuous singularity with time $t \to t_b = -\frac{1}{u_{0x}}$. Evidently, when $t < t_b$, $u_x < 0$ evolves continuously.

When $t > t_b$, $u_x > 0$. So, the convergent movement of the initial field ($u_{0x} < 0$) can be transformed into a divergent movement ($u_{0x} > 0$) through a blown-up. The characteristics of this kind of movement cannot be truly and faithfully described by linear analysis or statistical analysis. They reflect the fundamental characteristics of nonlinear evolutions.

2.3 The Problem of Quantitative Infinity

One of the features of blown-ups is the quantitative infinity ∞, which stands for indeterminacy mathematically. So, a natural question is how to comprehend this mathematical symbol ∞, which in applications causes instabilities and calculation spills that have stopped each and every working computer.

2.3.1 An Implicit Transformation Between Euclidean Spaces and Curvature Spaces

To address the previous question, let us look at the mapping relation of the Riemann ball, which is well studied in complex functions (Fig. 2.6). This so-called Riemann ball, a curved or curvature space, illustrates the relationship between the infinity on the plane and the North Pole N of the ball. Such a mapping relation connects $-\infty$ and $+\infty$ through a blown-up. Or in other words, when a dynamic point x_i travels through the North Pole N on the sphere, the corresponding image x_i' on the plane of the point x_i shows up as a reversal change from $-\infty$ to $+\infty$ through a blown-up. So, treating the planar points $\pm\infty$ as indeterminacy can only be a product of the thinking logic of a narrow or low dimensional observ-control, since, speaking generally, these points stand implicitly for direction changes of one dynamic point on the sphere at the polar point N. Or speaking differently, the phenomenon of directionless, as shown by blown-ups of a lower dimensional space, represents exactly a direction change of movement in a higher dimensional curvature space.

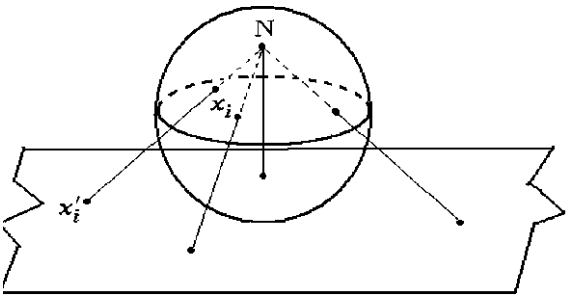

Fig. 2.6 The Riemann ball—relationship between planar infinity and three-dimensional north pole

Therefore, the concept of blown-ups can specifically represent implicit transformations of spatial dynamics. That is, through blown-ups, problems of indeterminacy of a narrow observ-control in a distorted space are transformed into determinant situations of a more general observ-control system in a curvature space. This discussion shows that the traditional view of singularities as meaningless indeterminacies has not only revealed the obstacles of the thinking logic of the narrow observ-control (in this case, the Euclidean space), but also the careless omissions of spatial properties of dynamic implicit transformations (bridging the Euclidean space to a general curvature space).

Corresponding to the previous implicit transformation between the imaginary plane and the Riemann ball, let us now look at how we can relate quantitative $\pm\infty$ (symbols of indeterminacy in one-dimensional space) to a dynamic movement on a circle (a curved space of a higher dimension) through the modeling of differential equations.

In the beginning of Sect. 2.2, we studied the blown-ups of quadratic models. Now, let us look at the essence of singularities by investigating spatial dynamic transformations. To make this presentation easier to follow, let us first cite some relevant results from Sect. 2.2 on quadratic evolution models. For the evolution described by

$$\dot{u} = a_0 + a_1 u + u^2, \tag{2.37}$$

we have three possibilities:

1. When $a_1^2 - 4a_0 = 0$,

$$u = -\left(\frac{1}{t + A_0} - \frac{1}{2}a_0\right). \tag{2.38}$$

2. When $a_1^2 - 4a_0 > 0$, there exist the following two possibilities:

(a) If $\left|\frac{1}{2}a_1 + u\right| < \frac{1}{2}\sqrt{a_1^2 - 4a_0}$, then

$$u = -\frac{1}{2}\sqrt{a_1^2 - 4a_0}\tanh\left(\frac{1}{2}\sqrt{a_1^2 - 4a_0}t + \frac{1}{2}A_0\right) - \frac{1}{2}a_1. \tag{2.39}$$

(b) If $\left|\frac{1}{2}a_1 + u\right| > \frac{1}{2}\sqrt{a_1^2 - 4a_0}$, then

$$u = \frac{1}{2}\sqrt{a_1^2 - 4a_0}\coth\left(-\frac{1}{2}\sqrt{a_1^2 - 4a_0}t - \frac{1}{2}A_0\right) - \frac{1}{2}a_1. \tag{2.40}$$

3. When $a_1^2 - 4a_0 < 0$, then

$$u = \frac{1}{2}\sqrt{4a_0 - a_1^2}\tan\left(\frac{1}{2}\sqrt{4a_0 - a_1^2}t + \frac{1}{2}A_0\right) - \frac{1}{2}a_1. \tag{2.41}$$

These results imply that other than Eq. 2.40, which represents a local smooth continuity, all other cases, as shown in Eqs. 2.38, 2.39 and 2.41, experience discontinuous blown-ups in their whole evolutions. Now, let us explain how these results on evolutions of quadratic evolutions correspond to the dynamic implicit transformations of the projection mapping between a planar circle and a straight line.

1. Implicit transformation between a planar circle and a line tangent to the circle.

For this situation, Fig. 2.7 depicts the dynamic relationship between the point p_i on the circle and the projection point $p_i^{'}$ on the tangent line. Here, the set of all points p_i is one-to-one corresponding to the set of all points $p_i^{'}$. Now, let the point N on the circle correspond to the singular point $+\infty$ on the tangent line. So, when the point $p_i^{'}$ travels directly from the singular point $+\infty$ to the other singular point $-\infty$ on the straight line, it simply reflects the traveling of the point p_i on the circle through the polar point N with a change in direction. Combining this explanation with the situation of two equal real roots of the quadratic form in Eq. 2.38, the movement of the point p_i is limited by u_0 (a real root or an equilibrium state). When the point p_i travels upward on the right-hand side of the circle, the corresponding point $p_i^{'}$ on the tangent line travels to $+\infty$. When the point p_i goes across the polar point N, the corresponding point $p_i^{'}$ leaps from $+\infty$ to $-\infty$ directly. That is, a direction change on the circle stands for a discontinuous singularity on the line, which is shown as a blown-up in Eq. 2.38.

2. Implicit transformation between a planar circle and a line secant to the circle.

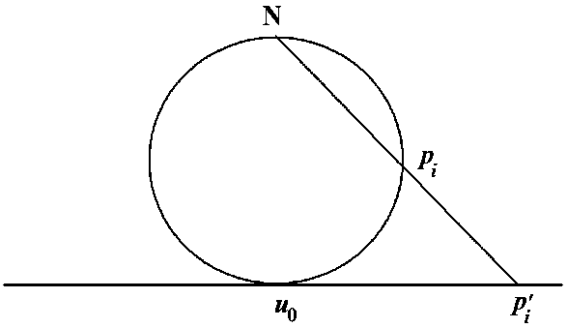

Fig. 2.7 The implicit transformation between a circle and a tangent line

If we focus on locally bounded movements, such as the point p_{i1} in Fig. 2.8, whose movement is limited by the distinct real roots u_1 and u_2, then the point p_{i1} cannot go across the boundaries u_1 and u_2 and would not be able to travel over the polar point N. So, the corresponding projection point on $p_{i1}^{'}$ the secant line will not approach either $+\infty$ or $-\infty$. That is, the point $p_{i1}^{'}$ does not experience any singularity. This fact corresponds exactly to the smooth continuous solution Eq. 2.39. If we do not limit ourselves to bounded movements, such as the movement of the point p_{i2} in Fig. 2.8, which can go across the polar point N, then the corresponding projection point $p_{i2}^{'}$ can approach $+\infty$ and be transformed into $-\infty$ when the point p_{i2} goes across the point N. This situation corresponds to the blown-up solution in Eq. 2.40.

3. Implicit transformation between a planar circle and a line disjoint from the circle.

This situation corresponds to the periodic blown-ups of Eq. 2.41 with $a_1^2 - 4a_0 < 0$ and $\sqrt{4a_0 - a_1^2}t + \frac{1}{2}A_0 = (\frac{1}{2} + 2k)\pi$, $k = 0, \pm 1, \pm 2, \ldots$ Since the movement of the point p_{i3} is not limited by any condition, it can go across the polar point N repeatedly, the corresponding projection $p_{i3}^{'}$ point on the line detached from the circle experiences periodic transformations from $+\infty$ to $-\infty$ or from $-\infty$ to $+\infty$, Fig. 2.9.

Our discussion here indicates that the traditional view of singularities as meaningless indeterminacies has not only revealed the obstacles of the thinking logic of the narrow observ-control, but also the careless omissions of spatial or dynamic implicit transformations.

Summarizing what has been discussed in this chapter, we can see that nonlinearity, speaking mathematically, stands (mostly) for singularities in the Euclidean spaces, the imaginary plane or the straight line discussed above. In terms of physics, nonlinearity represents eddy motions, the movements on the curvature spaces, the Riemann ball or the circle above. Such motions are a problem about structural evolutions, which are a natural consequence of uneven

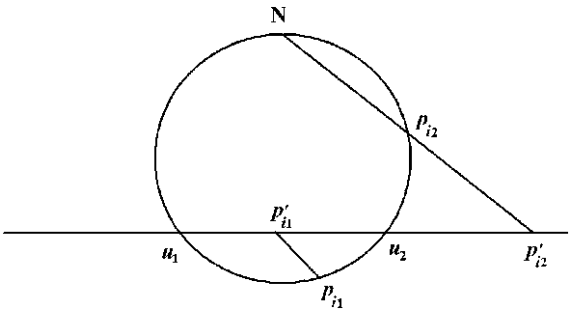

Fig. 2.8 The implicit transformation between a circle and a secant line

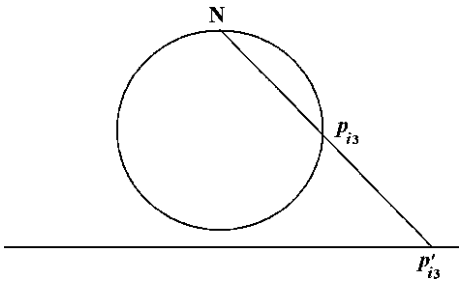

Fig. 2.9 The implicit transformation between a circle and a disjoint line

evolutions of materials. So, nonlinearity accidentally describes discontinuous singular evolutionary characteristics of eddy motions (in curvature spaces) from the angle of a special, narrow observ-control system, the Euclidean spaces. To support this end, please go to Sect. 2.3.1: Bjerknes' Circulation Theorem, for details.

2.3.2 Eddy Motions of the General Dynamic System

In this subsection, let us look at the general dynamic system and how it is related to eddy motions. The following is Newton's second law of motion

$$m\frac{\mathrm{d}\vec{v}}{\mathrm{d}t} = \vec{F}. \tag{2.42}$$

Based on Einstein's concept of uneven time and space of materials' evolutions, we can assume

$$\vec{F} = -\nabla S(t, x, y, z), \tag{2.43}$$

where $S = S(t, x, y, z)$ stands for the time–space distribution of the external acting object. Let $\rho = \rho(t, x, y, z)$ be the density of the object being acted upon. Then, the kinematic Eq. 2.42 for a unit mass of the object being acted upon can be written as

$$\frac{\mathrm{d}\vec{u}}{\mathrm{d}t} = -\frac{1}{\rho(t,x,y,z)}\nabla S(t,x,y,z), \tag{2.44}$$

where $\vec{u}$ is used to replace the original $\vec{v}$ in order to represent the meaning that each movement of some materials is a consequence of mutual reactions of materials' structures. Evidently, if ρ is not a constant, then Eq. 2.44 becomes

$$\frac{\mathrm{d}(\nabla x \times \vec{u})}{\mathrm{d}t} = -\nabla x \times \left[\frac{1}{\rho}\nabla S\right] \neq 0, \tag{2.45}$$

which stands for an eddy motion because of the nonlinearity involved. In other words, a nonlinear mutual reaction between materials' uneven structures and the unevenness of the external forcing object will definitely produce eddy motions.

On the other hand, since nonlinearity stands for eddy sourcess, it represents a problem about structural evolutions. This end has essentially resolved the problem of how to understand nonlinearity and also ended the particle assumption of Newtonian mechanics and the methodological point of view of melting shapes into numbers, which has been formed since the time of Newton in natural sciences. What is more important is that the concept of uneven eddy evolutions reveals the fact that forces exist in the structures of evolving objects, and does not exist independently out of objects, according to what Aristotle and Newton believed so that the movement of all things had to be pushed first by God. Based on such reasoning, the concept of second stir of materials' movements is introduced. At this junction, we need to point out that as early as over 2,500 years ago, Lao Tzu of China once said: "Tao is about physical materials. Even though nothing can be seen clearly, there exist figurative structures in the fuzziness." [Chap. 21, Tao Te Ching, (English and Feng, 1972)]. It is no doubt a scientific and epistemological progress that in our modern time, Einstein proposed that gravitations are originated from the unevenness of time and space, which had essentially ended the era of Aristotelian concept of forces existing independently outside of materials. However, due to the fact that Einstein did not notice the unevenness of time and space of the object being acted upon, he did not successfully reveal the essence of nonlinear mutual reactions.

For example, in terms of the problem of the universe's evolution, Newton needed the hands of God. The first push of God has been vividly seen in the second law of mechanics. Einstein had realized the materialism of forces. However, based on his general relativity theory, it is concluded that the universe is originated from a big bang out of a singular point. Obviously, the singular point represents the transition of materials' evolution, which possesses more realisticity of materials than Newton's hands of God. Therefore, the scientific community has accepted such a big bang theory. However, the acceptance does not mean that such a big bang theory has revealed the true evolution of the universe. It is because the theory of big bang is established on the basis of the universe's background radiation (3 K, where K is the absolute temperature index), which is assumed to be uniform in all directions. Next, should there be only one singular point? Since the so-called background radiation should also be originated from the unevenness of materials,

can the universe's background radiation be calm? Even though a calm state could be reached temporarily, there should be a pre-singular point universe. Since unevenness is the fundamental property of spinning materials and the origin of all multiple levels of materials' eddies, the corresponding singular point explosions should also be multiple. So, the big bang theory, as a scientific theory, is still not plausible.

As a matter of fact, the concept of second stir can also be extended into a theory about the evolution of the universe. Since the concept of the second stir assigns forces with materials' structures, it naturally ends Newton's God. The duality of rotations must lead to differences in spinning directions. Such differences surely lead to singular points of singular zones. Through sub-eddies and sub–sub-eddies, breakages (or big bangs) are represented so that evolutionary transitions are accomplished. Evidently, according to the concept of second stir, the number of singular points would be greater than one, and the big bang explosions would also have their individual multiplicities. Therefore, the concept of second stir will be a thought left behind from the twentieth century, concerning the physical essence of materials' evolutions, worthy of further and deepened thinking.

2.3.3 Wave Motions and Eddy Motions

The concept of wave motions originated from the morphological changes of materials in motion, such as vibrating solids, water, and sound waves caused by local distributions in fluids, etc., caused by reciprocating movements. Later, this concept was extended to studies of other physical phenomena and to suit mathematical needs to such an extent that all absolute concepts about disturbances are treated as wave motions. That is how this concept has been widely employed in a great many branches of natural and social sciences. Because the concept of wave motions, current employed in a wide array of studies, is no longer the same as that in physics, we will refer to this greatly generalized concept of wave motions as extended wave motions for the convenience of our communication.

The extended wave motions, on the other hand, define eddy and wave motions on the basis of physics of the root cause and properties of the relevant disturbances instead of the need to suit some detailed mathematical requirements.

If a disturbance is the morphological change caused by reciprocating (linear) movements of materials, it is called a wave motion. If the disturbance is the morphological changes caused by spinning (curvilinear) movements of materials, it would be referred to as an eddy motion. Therefore, wave motions and eddy motions are two different concepts of physics. To this end, each wave motion is at least two directional, while each eddy motion is unidirectional. Unidirectionality is the characteristic of flows. So, eddy motions can also be named eddy currents or spinning currents (Figs. 2.10, 2.11). In terms of mathematics, wave motions are linear problems, while eddy motions are nonlinear problems. The current widely employed concept of extended wave motions is essentially developed by

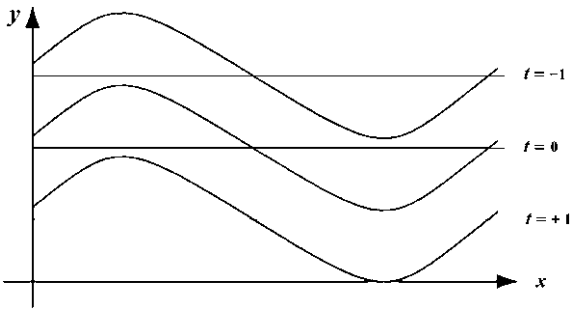

Fig. 2.10 A wave motion

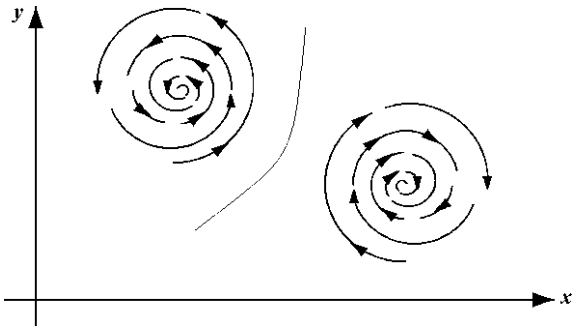

Fig. 2.11 An eddy motion

generalizing the original concept of wave motions to satisfy the requirements of relevant mathematical theories in order to establish the desired outcomes. As analyzed here, such generalization has caused confusion of concepts in physics. Typical examples of such confusion are extrapolations of the thinking logic of particle's continuity. Even if we assume such a generalization is OK, the continuity of the generalized wave motions is still conditional.

Speaking differently, even based on the traditional formal analysis, we can see the phenomenon of "break-offs" appearing in wave motions. To confirm this end, we will in the following use nonlinear dispersive "wave motions" as our platform to show this phenomenon.

Let the vibrating wave of an uneven material be written as follows:

$$\varphi(t,x) = A\ \cos\ \xi, \tag{2.46}$$

where $A = A(t,x)$ and $\xi = \xi(t,x)$ with t being the time variable and x the one-dimensional space. Then, the local wave number and frequency are given by

$$R(t,x) = \frac{\partial \xi}{\partial x} \text{ and } \omega(t,x) = -\frac{\partial \xi}{\partial t}. \tag{2.47}$$

Now, by eliminating ξ from Eq. 2.47, we produce

$$R_{\mathrm{t}} + \omega_x = 0. \tag{2.48}$$

Let us define the group speed as

$$C(R) = \frac{\partial \omega}{\partial R} \tag{2.49}$$

so that Eq. 2.48 becomes

$$R_t + \frac{\partial \omega}{\partial R} R_x = 0. \tag{2.50}$$

According to Eq. 2.49 it follows that the local wave number $R(t,x)$ satisfies the following quasi-linear hyperbolic equation

$$R_t + C(R)R_x = 0. \tag{2.51}$$

Now, Eq. 2.51 stands for a typical blown-up problem. If t_b is a point of discontinuity in the solution of Eq. 2.51, then when $t < t_b$, R evolves continuously and the corresponding wave motion is continuous. When $t = t_b$, R approaches ∞ or$L = \frac{2\pi}{R} \to 0$ experiences a blown-up with "broken" wave length. So, nonlinear dispersive wave motions can evolve through blown-up(s) so that long waves are transformed into "short waves" or "broken waves."

If when $t \to t_b$, $R_x = \frac{\partial R}{\partial x} \to \infty$, that is, the first order derivative of the wave number with respect to space experiences a blown-up, then from $R = \frac{2\pi}{L}$, it follows that

$$R_x = \left(\frac{2\pi}{L}\right)_x = -2\pi\left(\frac{L_x}{L^2}\right) \text{ or } \frac{L^2}{L_x} = -\frac{2\pi}{R_x},$$

where $R_x \to \infty$ and $L \to 0$. Therefore, uneven materials' nonlinear dispersive waves are a blown-up problem. This is fundamentally different from the continuous movement of linear dispersive waves of even materials.

Of course, the discussion above is about nonlinear "waves" in their mathematical forms. So, what has been said is only about the difference in the mathematical properties of linearity and nonlinearity. That difference should not and could not be employed to illustrate the corresponding physical morphologies and properties. So, nonlinear "waves" of the mathematical form are not equivalent to any physical existence of mutual reacting waves. Because wave motions are originated from the diverging or converging currents of materials, and because both diverging and converging currents of materials in objective and realistic processes always contain unevenness that causes twistings so that subeddies are formed and rotating eddy motions are resulted. The morphology of broken waves of materials must be spinning "spindriffs" instead of waves. Thus, wave motions are only local and relative physical phenomenon, while eddy motions, on the other hand, are the commonly existing physical morphology. Because the mutual reaction of uneven structures constitutes twisting forces, which is "twisting motions," spinning motions are inevitable results of mutual reactions of uneven materials, forming the origin from which eddy currents are from.

2.4 Equal Quantitative Effects

Another important concept studied in the blown-up theory is that of equal quantitative effects. Although this concept was initially proposed in the study of fluid motions, it essentially represents the fundamental and universal characteristics of all movements of materials. What is more important is that this concept reveals the fact that nonlinearity is originated from the figurative structures of materials instead of non-structural quantities of the materials.

The so-called equal quantitative effects stand for the eddy effects with non-uniform vortical vectorities existing naturally in systems of equal quantitative movements due to the unevenness of materials. And, by equal quantitative movements, it is meant the movements with quasi-equal acting and reacting objects or under two or more quasi-equal mutual constraints. For example, the relative movements of two or more planets of approximately equal masses are considered equal quantitative movements. In the microcosmic world, an often seen equal quantitative movement is the mutual interference between the particles to be measured and the equipment used to make the measurement. Many phenomena in daily lives can also be considered equal quantitative effects, including such events as wars, politics, economies, chess games, races, plays, etc.

Comparing to the concept of equal quantitative effects, the Aristotelian and Newtonian framework of separate objects and forces is about unequal quantitative movements established on the assumption of particles. On the other hand, equal quantitative movements are mainly characterized by the kind of measurement uncertainty that when I observe an object, the object is constrained by me. When an object is observed by another object, the two objects cannot really be separated apart. At this juncture, it can be seen that the Su-Shi Principle of Xuemou Wu's panrelativity theory (1990), Bohr (Bohr 1885–1962) principle and the relativity principle about microcosmic motions, von Neumann's Principle of Program Storage, etc., all fall into the uncertainty model of equal quantitative movements with separate objects and forces.

What is practically important and theoretically significant is that eddy motions are confirmed not only by daily observations of surrounding natural phenomena, but also by laboratory studies from as small as atomic structures to as huge as nebular structures of the universe. At the same time, eddy motions show up in mathematics as nonlinear evolutions. The corresponding linear models can only describe straight-line-like spraying currents and wave motions of the morphological changes of reciprocating currents. What is interesting here is that wave motions and spraying currents are local characteristics of eddy movements. This fact is very well shown by the fact that linearities are special cases of nonlinearities. Please note that we do not mean that linearities are approximations of nonlinearities.

Since 99% of all materials in the universe are fluids, and since under certain conditions solids can be converted to fluids, OuYang (1998) pointed out that "when fluids are not truly known, the amount of human knowledge is nearly zero.

And, the epistemology of the Western civilization, developed in the past 300 plus years, is still under the constraints of solids." This statement no doubt points to the central weakness of the current theoretical studies and also located the reason why "mathematics met difficulties in the studies of fluids," as said by Engels (1939). It also well represents Lao Tzu's teaching (English and Feng 1972): "If crooked, it will be straight. Only when it curves, it will be complete." As a matter of fact, mankind exists in a spinning universe with small eddies nested in bigger eddies or multiple eddies. Through sub-eddies and sub–sub-eddies, heat-kinetic energy transformations are completed. These nested eddies and energy transformations vividly represent the forever generation changes of blown-up evolutions of all things in the universe.

The birth–death exchanges and the non-uniformity of vortical vectorities of eddy evolutions naturally explain where and how quantitative irregularities, complexities, and multiplicities of materials' evolutions, when seen from the current narrow observ-control system, come from. Evidently, if the irregularity of eddies comes from the unevenness of materials' internal structures, and if the world is seen at the height of structural evolutions of materials, then the world is simple. And, it is so simple that there are only two forms of motions. One is clockwise rotation, and the other counterclockwise rotation. The vortical vectority in the structures of materials has very intelligently resolved the Tao of Yin and Yang of the "*Book of Changes*" of the eastern mystery (Wilhalm and Baynes 1967), and has been very practically implemented in the common form of motion of all materials in the universe. That is where the concept of invisible organizations of the blown-up system comes from.

The concept of equal quantitative effects not only possesses a wide range of applications, but also represents an important omission of modern science, developed in the past 300 plus years. Evidently, not only are equal quantitative effects more general than the mechanic system of particles with far-reaching significance, but also they have directly pointed to some of the fundamental problems existing in modern science. For instance,

1. Equal quantitative effects can throw calculations of equations into computational uncertainty. Evidently, if $x \approx y$, then $x-y$ becomes a mathematical problem of computational uncertainty, involving large quantities with infinitesimal increments. To this end, please consult with the second crisis in the foundations of mathematics (Kline 1972; Lin 2008a). Although this end has been well known, in practical applications, people are still often misguided into such uncertainties unconsciously. For example, in meteorological science, one situation involves

$$2\vec{\Omega} \times \vec{V}_h \approx -\frac{1}{\rho}\nabla ph$$

where the left-hand side stands for the deviation force caused by the earth's rotation and the right-hand side the stirring force of the atmospheric density

pressure. However, scholars have tried for many decades to compute $\frac{\mathrm{d}\vec{V}_h}{\mathrm{d}t}$ under the influence of such quasi-equal computational uncertainty. As a matter of fact, the concept of equal quantitative effects has computationally declared that equations are not eternal, or there does not exist any equation under equal quantities. That is why OuYang introduced the methodology of abstracting numbers (quantities) back into shapes (figurative structures). The purpose of abstracting numbers back into shapes is to describe the formalization of eddy irregularities, which is different from regularized mathematical quantification of structures. That is why we should very well see that if 300 years ago, it was human wisdom to abstract numbers out of everything, then it would be human stupidity to continue to do so today.

2. It is because the current variable mathematics is entirely about regularized computational schemes where there must be the problem of disagreement between the variable mathematics and irregularities of objective materials' evolutions. The corresponding quantified comparability can only be relative. And, at the same time, there exists a problem with quantification where distinct properties cannot be distinguished because the relevant quantifications produce the same indistinguishable numbers. Because of this, it is both incomplete and inaccurate to employ quantitative comparability as the only standard for judging scientificality. For example, in terms of weather forecasting, it should be clear that difficulties we have been facing are consequences of the incapability of the existing theories in handling equal quantitative effects. It can be also said that the quantitative science, developed in the past 300 plus years, is incomplete and incapable of resolving problems about figurative structures.
3. The introduction of the concept of equal quantitative effects has not only made the epistemology of natural sciences gone from solids to fluids, but also completed the unification of natural and social sciences. That is because many social phenomena, such as military conflicts, political struggles, economic competitions, chess games, races, plays, etc., can all be analyzed on the basis of figurative structures of equal quantitative effects. However, what needs to be pointed out is that the current system of natural sciences is basically extensions of the research under unequal quantitative effects. At the same time, in some areas of research, there has been the problem of misusing unequal quantitative effects. These areas include, but are not limited to, the Rossby's long waves in meteorology, topographic leeward wave theory, chaos theory, etc.

In order for us to intuitively see why equal quantitative effects are so difficult for modern science to handle by using the theories established in the past 300 plus years, let us first look at why all materials in the universe are in rotational movements. According to Einstein's uneven space and time, we can assume that all materials have uneven structures. Out of these uneven structures, there naturally exist gradients. With gradients, there will appear forces. Combined with uneven arms of forces, the carrying materials will have to rotate in the form of moments of

forces. That is exactly what the ancient Chinese Lao Tzu, (English and Feng 1972) said: "Under the heaven, there is nothing more than the Tao of images," instead of Newtonian doctrine of particles (under the heaven, there is such a Tao that is not about images but sizeless and volumeless particles). The former stands for an evolution problem of rotational movements under stirring forces. Since structural unevenness is an innate character of materials, that is why it is named second stir, considering that the phrase of first push was used first in history (OuYang et al. 2000). What needs to be noted is that the phrases of first push and second stir do not mean that the first push is prior to the second stir.

Now, we can imagine that the natural world and/or the universe is composed of entirely with eddy currents, where eddies exist in different sizes and scales and interact with each other. That is, the universe is a huge ocean of eddies, which change and evolve constantly. One of the most important characteristics of spinning fluids, including spinning solids, is the difference between the structural properties of inwardly and outwardly spinning pools and the discontinuity between these pools. Due to the stirs in the form of moments of forces, in the discontinuous zones, there exist subeddies and sub–subeddies (Fig. 2.12, where subeddies are created naturally by the large eddies M and N). Their twist-ups (the subeddies) contain highly condensed amounts of materials and energies. Or in other words, the traditional frontal lines and surfaces (in meteorology) are not simply expansions of particles without any structure. Instead, they represent twist-up zones concentrated with irregularly structured materials and energies [this is where the so-called small probability events appear and small probability information is observed and collected, so such information (event) should also be called irregular information (and event)]. In terms of basic energies, these twist-up zones cannot be formed by only the pushes of external forces and cannot be adequately described by using mathematical forms of separate objects and forces. Since evolution is about changes in materials' structures, it cannot be simply represented by different speeds of movements. Instead, it is mainly about transformations of rotations in the form of moments of forces ignited by irregularities. The enclosed areas in Fig. 2.13 stand for the potential places for equal quantitative effects to appear, where the combined pushing or pulling is small in absolute terms. However, it is generally difficult to predict what will come out of the power struggles. In general, what comes out of the power struggle tends to be drastic and unpredictable by using the theories and methodologies of modern science.

Summarizing what has been discussed above, when a mathematical model, which truthfully and adequately describe the physical situation of our concern, blows up at a specific time moment or a specific spatial location or both and the underlying physical system also goes through a transitional change, then the solution of the model is called a blown-up solution and the relevant physical movement expresses a blown-up. Blown-up phenomena appear in life all the time, especially in studies involving evolutions.

The main points of our discussion above can be described as follows. For the situation that blown-ups appear only with time, by analyzing nonlinear equations and more general nonlinear models, it is found that in most cases, nonlinearity

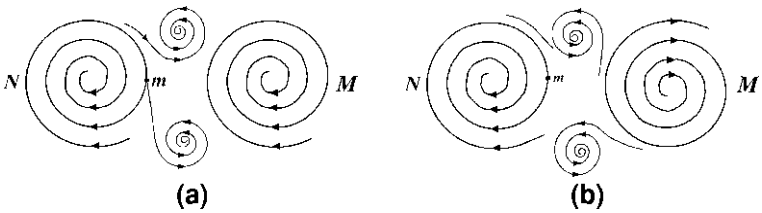

Fig. 2.12 Appearance of sub-eddies

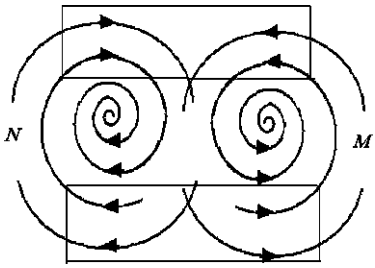

Fig. 2.13 Structural representation of equal quantitative effects

implies blown-ups and the requirements for well-posedness of modern science (existence, uniqueness, and stability) do not hold true, meaning that most of the methods and thinking logic in modern science cannot be employed to resolve the relevant problems involving nonlinearity. Only under very special local conditions, there will not be any blown-up. That is when the available methods and theories in modern science can be applied. When blown-ups appear in both time and space, it is shown that if a system, when seen as a rotational entity, is initially divergent, then over time the whole evolution of the system is continuous and the divergent development of the system will eventually disappear smoothly and quietly. However, if the initial state of the system is convergent, then it is guaranteed that a moment of blown-up will appear at a definite time moment in the foreseeable future. After the system goes through a transitional change (blown-up), it will restart as a divergent system.

By introducing the concept of implicit transformations between a Euclidean space and a curvature space, it is shown that blown-ups in the Euclidean space are simply some transitional changes in the curvature space. And, periodic blown-ups of the Euclidean space and rotational movements in the curvature space correspond very well, illustrating a method on how to resolve the problems of the quantitative∞, numerical instability, and computational spills, by reconsidering the situations in curvature spaces. By doing so, all these problems, which seem unsolvable in modern science, are avoided.

It is concluded that the physical characteristics of blown-ups are spinning currents, which will be shown theoretically and empirically in the next chapter. One of the very significant outcomes of this discovery is that discontinuities and singularities existing in calculus-based models can actually be applied as a tool to

predict forthcoming transitional changes. By looking at the general dynamic system, it is shown that Newton's second law of mechanics actually indicates that as long as the acting and reacting objects have uneven structures, their mutual reaction will be nonlinear and a rotational movement. So, the concept of second stir is introduced. On the basis of this new concept, new explanations and a generalization of the big bang theory are provided in terms of a new theory on the evolution of the universe.

With the theoretical background established for rotations to be the common form of movements in the universe, the concepts of equal quantitative effects and equal quantitative movements are introduced. Through using these concepts, it is analyzed that mathematical nonlinearity is created by uneven internal structures of the materials involved instead of the non-structural quantities of the materials. It is found that equal quantitative effects lead to computational uncertainties and have the ability to unify natural and social sciences, since in both situations, figurative structural analyses can be employed. By looking at the geometry of equal quantitative effects, one can easily locate where small probability events would appear and where small probability information can be observed.

Let us conclude this chapter with a note on the references. Other than at specific locations we have directly pointed to the source of information, the presentation of this chapter is mainly based on Glassey (1977), Guo (1995), Hess (1959), Holton (1979), Kuchemann (1965), Lin (2000a), Lin and Fan (1997), Lin and OuYang (1998), Lin and Wu (1998), Lorenz (1993), OuYang (1994; 1995; 1998; 1998a), OuYang, Miao, Wu, Lin, Peng, and Xiao (2000), OuYang, Wu, Lin and Li (1998), Saltzman (1962), Wu (1990), Wu (1998), and Wu and Lin (2002). For more details and references, please consult with these works.

Chapter 3
Several Empirical Justifications

Continuing on what was done in the previous chapter, we will in this chapter study several empirical evidences and observations that underline the existence of the yoyo structure behind each and every system, which either tangibly exists or is intellectually imaginable.

3.1 Bjerknes' Circulation Theorem

Based on rigorous mathematical reasoning, it is concluded in Sect. 2.3 that nonlinearity, speaking mathematically, stands (mostly) for singularities in Euclidean spaces, the imaginary plane or the straight line discussed above. In terms of physics, nonlinearity represents eddy motions, the movements in the curvature spaces, the Riemann ball or the circle above. Such motions are a problem of structural evolutions, which are a natural consequence of uneven evolutions of materials. So, nonlinearity accidentally describes discontinuous singular evolutionary characteristics of eddy motions (in curvature spaces) from the angle of a special, narrow observ-control system, the Euclidean spaces (the imaginary plane or line). To support this end, let us now look at the Bjerknes' Circulation Theorem (1898).

At the end of the nineteenth century, Bjerkes (1898) discovered the eddy effects due to changes in the density of the media in the movements of the atmosphere and ocean. He consequently established the well-know circulation theorem, which was later named after him. Let us look at this theorem briefly.

By a circulation, it is meant to be a closed contour in a fluid. Mathematically, each circulation Γ is defined as the line integral about the contour of the component of the velocity vector locally tangent to the contour. In symbols, if $\vec{V}$ stands for the speed of a moving fluid, S an arbitrary closed curve, $\delta\vec{r}$ the vector difference

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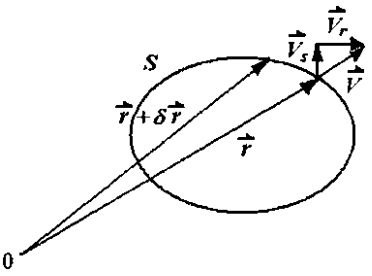

Fig. 3.1 The definition of a closed circulation

of two neighboring points of the curve S (Fig. 3.1), then a circulation Γ is defined as follows:

$$\Gamma = \oint_S \vec{V}\delta\vec{r}. \tag{3.1}$$

Its rate of change with respect to time is given by

$$\frac{\mathrm{d}\Gamma}{\mathrm{d}t} = \frac{\mathrm{d}}{\mathrm{d}t}\oint_S \vec{V}\delta\vec{r}. \tag{3.2}$$

The right-hand side of this equation can be written as follows:

$$\frac{\mathrm{d}}{\mathrm{d}t}\oint_S \vec{V}\delta\vec{r} = \oint_S \frac{\mathrm{d}\vec{V}}{\mathrm{d}t}\times\delta\vec{r} + \oint_S \vec{V}\times\frac{\mathrm{d}}{\mathrm{d}t}\delta\vec{r}. \tag{3.3}$$

Based on the assumption of continuity, we have

$$\frac{\mathrm{d}}{\mathrm{d}t}\delta\vec{r} = \delta\left(\frac{\mathrm{d}\vec{r}}{\mathrm{d}t}\right) = \delta\vec{V}. \tag{3.4}$$

Substituting Eq. 3.4 into the second term on the right-hand side of Eq. 3.3 produces

$$\oint_S \vec{V}\times\frac{\mathrm{d}}{\mathrm{d}t}\delta\vec{r} = \oint_S \delta\left(\frac{\vec{V}^2}{2}\right) = 0. \tag{3.5}$$

So, Eq. 3.2 becomes

$$\frac{\mathrm{d}\Gamma}{\mathrm{d}t} = \oint_S \frac{\mathrm{d}\vec{V}}{\mathrm{d}t}\delta\vec{r}, \tag{3.6}$$

which is also called an accelerating circulation. The Euler equation in fluid mechanics is given by

$$\frac{\mathrm{d}\vec{V}}{\mathrm{d}t} = -\frac{1}{\rho}\nabla p - 2\vec{\Omega}\times\vec{V} + \vec{g}, \tag{3.7}$$

where p stands for the atmospheric pressure, ρ the density, $\vec{g}$ the gravitational acceleration, $\vec{\Omega}$ the earth's rotational angular speed. The first term on the right-hand side of Eq. 3.7 is referred to as a pressure gradient force, the second term the Coriolis force. Substituting Eq. 3.7 into Eq. 3.6 produces

$$\frac{\mathrm{d}\Gamma}{\mathrm{d}t} = \oint_S \left(-\frac{1}{\rho}\nabla p\right)\delta\vec{r} - \oint_S 2\left(\vec{\Omega}\times\vec{V}\right)\times\delta\vec{r} + \oint_S \vec{g}\times\delta\vec{r}. \tag{3.8}$$

Assume that A is the area enclosed by the closed curve S (Fig. 3.1). Then, the second term on the right-hand side of Eq. 3.8 is

$$\oint_S 2\left(\vec{\Omega}\times\vec{V}\right)\times\delta\vec{r} = 2\vec{\Omega}\times\oint_S \vec{V}\times\delta\vec{r} = 2\vec{\Omega}\times\oint_S \vec{n}V_r\times\delta r, \tag{3.9}$$

where $\vec{n}$ is the unit vector perpendicular to the plane generated by $\vec{V}$ and $\delta\vec{r}$, V_r the component of $\vec{V}$ in the direction perpendicular to $\delta\vec{r}$. That is,

$$\left|\vec{V}\right|\sin\theta\delta r = V_r\delta r.$$

So, we have

$$\oint_S 2\left(\vec{\Omega}\times\vec{V}\right)\times\delta\vec{r} = 2\vec{\Omega}\times\oint_S \vec{n}V_r\times\delta r = 2\Omega\frac{\mathrm{d}\sigma}{\mathrm{d}t}, \tag{3.10}$$

where σ is the projection of the area A on the equator plane.

If $\vec{g}$ is taken to be the gradient of the potential function φ, that is, $\vec{g} = -\nabla\varphi$, then we have

$$\oint_S \vec{g}\delta\vec{r} = -\oint_S \nabla S\times\delta\vec{r} = \oint_S \delta\phi = 0. \tag{3.11}$$

Now, substituting Eqs. 3.10 and 3.11 into Eq. 3.8 produces the following well-known Bjerknes' Circulation Theorem:

$$\frac{\mathrm{d}\vec{V}}{\mathrm{d}t} = \int_\sigma\int \nabla\left(\frac{1}{\rho}\right)\times(-\nabla p)\times\delta\sigma - 2\Omega\frac{\mathrm{d}\sigma}{\mathrm{d}t}, \tag{3.12}$$

where σ is the projection area on the equator plane of the area enclosed by the closed curve S, p the atmospheric pressure, ρ the density of the atmosphere, and Ω the earth's rotational angular speed.

The left-hand side of Eq. 3.12 represents the acceleration of the moving fluid, which according to Newton's second law of motion is equivalent to the force acting on the fluid. On the right-hand side, the first term is called a solenoid term in meteorology. It is originated from the interaction of the p- and ρ-planes due to uneven density ρ so that a twisting force is created. Consequently, materials'

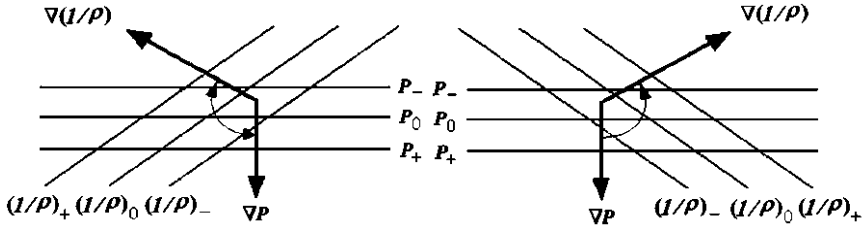

Fig. 3.2 A diagram for solenoid circulations

movements must be rotations with the rotating direction determined by the equal p- and ρ-plane distributions (Fig. 3.2). The second term in Eq. 3.12 comes from the rotation of the earth.

In college textbooks, Bjerknes' Circulation Theorem is applied to explain the formation of land–ocean breezes. In history, there existed people, such as Saltzman (1962), who have seen this circulation theorem as a major betrayal of the classical mechanics. And, OuYang assigned this theorem a very high value. He believes that in his effort of revealing the commonly existing and practically significant eddy effects of fluid motions, Bjerknes' Circulation Theorem has and will play an increasingly important role. This theoretical result has not only changed many opinions drawn on the classical theories of fluids, but also, more importantly, resolved the mystery of nonlinearity (Lin 1998a) which has been puzzling the mankind for the past 300 plus years, and revealed the universal law of materials' evolutions. The significance of this theorem also includes:

1. In terms of dynamics, an uneven density ρ implies eddy effects instead of the so-called effects of elastic pressure. The pressure gradient force $\left(-\frac{1}{\rho}\nabla p\right)$ should also be referred to as the stirring gradient force of the density pressure. Therefore, $\left(-\frac{1}{\rho}\nabla p\right)$ is an eddy source. In the form of mathematics, it is nonlinear. So, nonlinearity implies eddy sources. Furthermore, uneven eddy motions are the most common form of materials' movements observed in the universe. This Bjerknes' Circulation Theorem has clearly shown this fact, even though he and scholars of the following generations did not recognize this implication until OuYang pointed it out.
2. In the universe, the common form of materials' movements is eddies, such as the eddy motions of the solar system, galaxies, nebula, etc., in the cosmic level; polar eddies, cyclones, anticyclones, etc., on earth at the meso-scale level; at the microscopic level, various rotational movements are found in atomic structures. That is why Kuchemann (1961) once claimed that "the tendon of moving fluids is eddies." What OuYang said is that the field of eddies is both a place with high concentration of fluids' kinetic energies and a place with

efficient transformations of kinetic energies into heat energies. In this sense, people are reminded of the fact that without eddy motions, there would not be any transformation of kinetic energies (Lin 2008b). Through concentration of kinetic energies and through transformations of these energies into heat energies, eddies actually consume kinetic energies. Such a rise-and-fall of energies determines the equilibrium of the heat-kinetic forces, internal to the eddies, and reflects the close relationship between the quantities of eddies and transformations of energies.

3. Shi-jia Lu, a well-known Chinese scholar, once pointed out that "the essence of fluids is eddies, since fluids cannot stand twisting forces and as soon as a twist exists, eddies appear," (unpublished lecture notes). Because uneven densities create twisting forces, fields of spinning currents are naturally created. Such fields do not have uniformity in terms of types of currents. Clockwise and counter clockwise eddies always coexist, leading to destructions of the initial smooth, if any, fields of currents. When such evolutions are reflected in the continuous analytical methodology of any calculus-based narrow observ-control system, discontinuous singularities in solutions will naturally appear. Conversely, discontinuities of nonlinear differential equations offer us an analytic method for predicting discontinuous transitional changes of materials and for predicting the appearance of fields of eddy currents. However, in order to truly resolve this kind of problem of evolutions, we should give up the available analytic method, developed on the assumption of continuity, and search for new ideas and new methods for a more effective approach for analyzing nonlinearity.

3.2 Conservation of Informational Infrastructure

Some branches of modern science were made "exact" by introducing various laws of conservation, even though, at the times when they were proposed, there might not have been any "theoretical or mathematical" foundations for these laws. Walking along the similar lines, Lin (1995) developed a theoretical foundation for some laws of conservation, such as the laws of conservation of matter-energy, of fundamental particles, etc., on the basis of general systems theory. By addressing some problems related to the discussions in (Lin 1995), Lin and Fan (1997) systematically showed that human understanding of nature can be very much limited by our sensing organs, even though our constant attempts do help us get closer to the true state of the nature.

In this section, based on an intuitive understanding of the concept of general systems, one can intuitively see that there should exist a law of conservation emphasizing on the uniformity of "spatial structures" of various "systems". Starting with this intuition, several areas of scientific research are searched and similarities among these areas are found. Based on these "similarities", a law of conservation of informational infrastructure is proposed and some possible impacts and consequences of this law are explored. Connecting to what has been

presented earlier, it is expected that this presentation will help to provide an empirical evidence for the systemic yoyo model for each and every general system, which is either physically tangible or intellectually imaginable.

Now, let us look at the intuitive understanding of the concept of general systems, which forms the heuristic foundation of the entire work presented in this section on the law of conservation of informational infrastructure.

From a practical point of view, a system is what is distinguished as a system (Klir 1985). From a mathematical point of view, a system is defined as follows (Lin 1987): S is a (general) system, provided that S is an ordered pair (M, R) of sets, where M is the set of objects of the system S and R a set of some relations on the set M. The sets M and R are called the object set and the relation set of the system S, respectively. (For those readers who are sophisticated enough in mathematics, for each relation r in R, it implies that there exists an ordinal number $n = n(r)$, a function of r, such that r is a subset of the Cartesian product of n copies of the set M.) The idea of using an ordered pair of sets to define the general system is to create the convenience of comparing systems. In particular, when two systems S_1 and S_2 are given, by writing each of these systems as an ordered pair (M_i, R_i), $i = 1, 2$, we can make use of the known facts of mathematics to show that $S_1 = S_2$, if, and only if $M_1 = M_2$ and $R_1 = R_2$. When two systems S_1 and S_2 are not equal, then with their ordered pair structures, we can readily investigate their comparisons, such as how and when they are similar, congruent, or one is structurally less than the other, and other properties between systems. For more details about this end, please consult with (Lin 1999).

By combining these two understandings of general systems, we can intuitively see the following: Each thing that can be imagined in human minds is a system according to Klir's definition so that this thing would look the same as that of an ordered pair (M, R) according to Lin's definition. Furthermore, relations in R can be about some information of the system, its spatial structure, its theoretical structure, etc. That is, there should exist a law of conservation that reflects the uniformity of all tangible and imaginable things with respect to:

1. The content of information;
2. Spatial structures;
3. Various forms of movements, etc.

In the rest of this section, to support this intuition of (general) systems we will look at examples from several different scientific disciplines. To this end, owning to the wide range of disciplines covered in this section, many well-established scholars in the relevant fields have been consulted, including Professors Zhang Guodong, Xiao Xinghua, Huang Yongchang, Zheng Jiyan, Song Zhanghai, and Wang Wei. Their time, advice, and beneficial discussions that have greatly improved the presentation of this section are appreciated. Roughly speaking, what is presented in this section summarizes the collective wisdom of more than 300 years of scientific training, teaching, and discovery. The presentation in this section is mainly from (Ren et al. 1998).

3.2.1 Physical Essence of Dirac's Large Number Hypothesis

Dirac (1937), the founder of quantum mechanics, proposed the well-known large number hypothesis. This hypothesis implies that the ratio of the static electrical force and the universal gravitation in an H_2 atom is given as follows:

$$\frac{e^2}{Gm_pm_e} = 2 \times 10^{39}, \tag{3.13}$$

where e^2 is the static electric force in an H_2 atom, G the gravitational constant, m_p the mass of the proton, and m_e mass of the electron. In terms of the atomic unit, the age of the universe is 2×10^{39}. Dirac considered these two non-dimensional large numbers being very close and believed that it could not be a coincidence and that it must stand for something fundamental.

Here, it can be seen that one important contribution Dirac made is that he formally established a connection between the universe and the microscopic world. However, what is the most essential physical meaning of such a connection of the two worlds of different scales? To this end, Dirac concluded that the large number hypothesis implies that the gravitational "constant" G decreases as time advances and causes various matters being created. Now, let us explore the meaning of the large number hypothesis from a different angle. According to Allen (1976), in an H_2 atom, the static electrical force is

$$e^2 = 2.307113 \times 10^{-19} (\text{static electricity unit}),$$

the gravitational constant is

$$G = 6.672 \times 10^{-8}\,\text{dyne} \times \text{cm}^2/\text{g},$$

the mass of the proton is

$$m_p = 1.6726485 \times 10^{-24}\,\text{g},$$

the mass of the electron is

$$m_e = 9.109534 \times 10^{-28}\,\text{g},$$

the speed of light is

$$c = 2.99792458 \times 10^{10}\,\text{cm/s},$$

and the radius of a classical electron is

$$r_e = e^2/\left(m_e c^2\right) = 2.817938 \times 10^{-13}\,\text{cm}.$$

Based on Pan (1980), let us take the Hubble constant

$$H = 55\,\text{km} \times \text{s}^{-1} \times \text{Ma par sec}^{-1} = 1.782428367 \times 10^{-18}\text{s}^{-1}.$$

Now, from all these data values, we can compute:

1. In an H_2 atom, the ratio of the static electrical force and the universal gravitation is

$$\frac{e^2}{Gm_p m_e} = 2.269 \times 10^{39} \tag{3.14}$$

2. The ratio of the age of the universe (= $1/H$, approximately a Hubble age) and the time $\left(\frac{e^2/(m_e c^2)}{c}\right)$ needed for a light beam to travel through the distance equal to the radius of an electron is given as follows:

$$\frac{1/H}{e^2/(m_e c^2)/c} = 5.96866 \times 10^{40} \tag{3.15}$$

which can be rewritten as the ratio of the "radius of the universe" (= c/H, the Hubble distance) and the radius of an electron $\left(\frac{e^2}{m_e c^2}\right)$ as follows:

$$\frac{c/H}{e^2/(m_e c^2)} = 5.96866 \times 10^{40} \tag{3.16}$$

From Eqs. 3.14 and 3.15 or Eqs. 3.14 and 3.16, it can be seen that these two large numbers differ by only a ten. Therefore, for numbers of such a magnitude, they can be seen as approximately equal. At this junction, we can tell that some undiscovered important physical essence might be very well implied by such an uniformity in the structural information of the microcosm and the macrocosm. If these two quantities are seen as roughly equal, that is

$$\frac{e^2}{Gm_p m_e} \approx \frac{1/H}{e^2/(m_e c^2)/c} \approx \frac{c/H}{e^2/(m_e c^2)}. \tag{3.17}$$

Cross-multiplying Eq. 3.17 gives

$$Gm_p m_e \times \frac{1}{H} \approx e^2 \times \frac{e^2/(m_e c^2)}{c} \tag{3.18}$$

or

$$Gm_p m_e \times \frac{c}{H} \approx e^2 \times \frac{e^2}{m_e c^2} \tag{3.19}$$

The meaning of Eqs. 3.18 and 3.19 is that: The product of the universal gravitation and the age of the universe (or the "radius of the universe") approximately equals the product of the static electrical force (in an H^2 atom) and the

time for a light beam to travel the distance of the radius of an electron (or "the radius of an electron").

Since the measures for the universe are connected by the universal gravitation, and the measures for atoms in the microcosm are connected by electromagnetic force, the physical meaning of Eqs. 3.18 and 3.19 becomes clear: The product of physical quantities of the universal scale approximately equals the product of relevant physical quantities of the microcosm. That is to say that there is uniformity between the universe and the atomic world. Does this physical meaning of the large number hypothesis imply the following: besides the unification of the four basic physical forces in the physical world, electromagnetic interaction, weak interaction, strong interaction, and gravitational interaction, there might be a grand unification in which the products of some relevant physical quantities in the universal scale and in the micro-scale approximately equal a fixed constant?

To this end, we have the following facts: According to Xian and Wang (1987), the radius of an H^2 atom (Bohr radius) is given by

$$r_y = 0.529 \times 10^{-8}\,\text{cm},$$

the course velocity (reaction rate) of electromagnetic interactions is

$$V_{ce} = 10^{16} - 10^{19}\,\text{s}^{-1}.$$

The forcing distance of strong interactions satisfies

$$r_q \lesssim 10^{-13}\,\text{cm},$$

the course velocity of strong interactions is given by

$$V_{cq} = 10^{21} - 10^{23}\,\text{s}^{-1}.$$

So, the following is obtained:

$$r_y \times V_{ce} = 0.529 \times 10^{8} - 0.529 \times 10^{11}\,\text{cm} \times \text{s}^{-1} \tag{3.20}$$

and

$$r_q \times V_{cq} \lesssim 10^{8} - 10^{10}\,\text{cm} \times \text{s}^{-1}. \tag{3.21}$$

That is, we have obtained

$$r_y \times V_{ce} \approx r_q \times V_{cq}. \tag{3.22}$$

The meaning of Eq. 3.22 is that the product of some physical quantities of electromagnetic interactions approximately equals that of relevant physical quantities of strong interactions. This end implies that there exists uniformity between electromagnetic interactions and strong interactions.

3.2.2 The Mystery of the Solar System's Angular Momentum

The mystery of our solar system's angular momentum can be stated as follows: In the solar system, the total mass of all planets accounts for 0.135 percent of the total mass of the solar system, while the total angular momentum of all planets accounts for 99.421 percent of the total angular momentum of the solar system. Or in other words, the mass of the sun amounts to 99.865 percent of the mass of the solar system, while the angular momentum of the sun only amounts to 0.579 percent of the total angular momentum of the solar system. Two natural questions here are: How did this mystery of the solar system's angular momentum form? And are the masses and the relevant angular momentums related?

Here, in this subsection, the masses and the relevant angular momentums will be treated in the same fashion as above: multiply them together, see Ren and Hu (1989) for more details. In Dai (1979), the masses and relevant angular momentums with respect to the center mass of the solar system of the sun and the planets in the solar system are given. So, the sum of all the products of the masses (m_p) and their angular momentums (J_p) of all the planets can be obtained as follows:

$$\sum_p m_p J_p = 4.144 \times 10^{88}\,\mathrm{g}^2 \times \mathrm{cm}^2 \times \mathrm{s}^{-1}, \tag{3.23}$$

and the product of the mass $m_\oplus$ and the angular momentum $J_\oplus$ with respect to the center of mass of the solar system of the sun can be obtained as follows:

$$m_\oplus \times J_\oplus = 4.143 \times 10^{88}\,\mathrm{g}^2 \times \mathrm{cm}^2 \times \mathrm{s}^{-1}. \tag{3.24}$$

The numerical values in Eqs. 3.23 and 3.24 are very close and can be seen as the same. That is, we have seen the following law of conservation: The product of the mass and the angular momentum of the sun equals the sum of the products of the masses and the relevant angular momentums of all the planets. In this way, the mystery of the solar system's angular momentum can be resolved as follows: Under the conditions of time and space of the solar system, there exists the conservation of phenomenon of equal mass-angular momentum products between the sun and the planets. Hence, it is very possible that the stability of the solar system is realized through the law of conservation: equal mass-angular momentum products between the sun and the planets.

In terms of celestial mechanics, it can be shown (Ren and Hu 1989) that in a system, consisting of two celestial bodies, (a two-body problem), the motion of the smaller-mass body can be obtained by solving the dynamic equation that describes how the smaller-mass body (m) circles around the larger-mass body (M). From

$$J = mr^2 \frac{\mathrm{d}\sigma}{\mathrm{d}t} = m\sqrt{G(M+m)a(1-e^2)}, \tag{3.25}$$

where J stands for the orbital angular momentum, r the orbital vector, $\frac{d\sigma}{dt}$ the angular velocity, a the orbital radius, and e the orbital eccentric rate. By establishing a rectangular coordinate system with the origin located at the center of mass of the two-body system, we can derive the angular momentum J_1 of the center of larger-mass celestial body and the angular momentum J_2 of the smaller-mass celestial body as follows:

$$J_1 = \frac{Mm}{(M+m)^2} J \tag{3.26}$$

and

$$J_2 = \frac{M^2}{(M+m)^2} J. \tag{3.27}$$

Since the center mass of the two-body system is always located on the line segment connecting the two celestial bodies, it now follows obviously from Eqs. 3.26 and 3.27 that

$$MJ_1 = mJ_2. \tag{3.28}$$

That is, the predicted law of conservation has been obtained: The product of the mass and the angular momentum with respect to the center of mass of the two-body system of the larger-mass celestial body (center body) is the same as that of the smaller-mass celestial body (circling body).

As an example, let us look at the two-body system of the earth and the moon. Based on the numerical values of the masses and the angular momentums with respect to the center of mass of the earth−moon system (Dai 1979), we can calculate and obtain that

$$J_2 = 2.786 \times 10^{41}\ \mathrm{g} \times \mathrm{cm}^2 \times \mathrm{s}^{-1},$$

$$J_1 = 3.4266 \times 10^{38}\ \mathrm{g} \times \mathrm{cm}^2 \times \mathrm{s}^{-1},$$

and

$$MJ_1 = 2.0477 \times 10^{67}\ \mathrm{g}^2 \times \mathrm{cm}^2 \times \mathrm{s}^{-1} = mJ_2. \tag{3.29}$$

Equation 3.29 implies that in our earth−moon system, the law of conservation of identical mass-angular-momentum products holds true.

For a system of a large-mass celestial body and many small-mass circling celestial bodies, it can be shown (Xian and Wang 1987) that the related multiplicative relationships of mass-angular-momentums approximately hold true in the form of additive components. So, it can be seen that in a celestial body system of a simple mechanics, there is a new law of conservation of mass-angular momentum products between the center celestial body and the circling celestial bodies.

3.2.3 Measurement Analysis of Movements of the Earth's Atmosphere

In meteorology, weather systems, representing movements of the earth's atmosphere, are classified as large-(lar), medium-(mid), small-(li), and micro-(mic) scale systems. These systems of different classifications have their scales of spatial level measurements (L) set at approximately 10^8, 10^7, 10^6, 10^5 cm, their measures of vertical velocity (W) set at approximately 10^0, 10^1, 10^2, 10^3 cm $\times$ s^{-1}, and the measures of their life spans (τ) at approximately at 10^6, 10^5, 10^4, 10^3 s, respectively.

Similar to what has been done previously, let us now again multiply relevant quantities for weather systems of the same classification and obtain the following:

1. For the products of spatial level measures and relevant vertical velocities, we have:

$$\begin{aligned} L_{lar} \times W_{lar} &\approx 10^8\,cm^2 \times s^{-1} \\ &\approx L_{mid} \times W_{mid} \\ &\approx L_{li} \times W_{li} \\ &\approx L_{mic} \times W_{mic} \end{aligned} \tag{3.30}$$

2. For the products of life spans and relevant vertical velocities, we have:

$$\begin{aligned} \tau_{lar} \times W_{lar} &\approx 10^6\,cm^2 \\ &\approx \tau_{mid} \times W_{mid} \\ &\approx \tau_{li} \times W_{li} \\ &\approx \tau_{mic} \times W_{mic} \end{aligned} \tag{3.31}$$

Equations 3.30 and 3.31 obviously mean that no matter which classification of a weather system is in, the products of its spatial level measure and its vertical velocity is always approximately equal to a fixed constant; and the same holds true for the product of the system's life span and its vertical velocity. That is to say, in the earth atmosphere, there also exists a law of conservation of products between different spatial measures and relevant vertical velocities or between different life spans and relevant velocities.

3.2.4 The Law of Conservation of Informational Infrastructure

As is well-known, laws of conservations are the most important laws of nature. For example, in classical physics, there are many established laws of conservation dealing with many important concepts, such as mass, energy, momentum, moment

of momentum, electric charge, etc. The research of modern physics indicates that each moving object in an even and isotropic space and time, no matter whether the space is microscopic, or mesoscopic, or macroscopic, a particle or a field, must follow the laws of conservation of energy, momentum and moment of momentum. That is, a unification of space has been achieved, which is called a Minkowski space. In Einstein's relativity theory, the concepts of mass, time, and space have been closely connected; and the mass-energy relation realizes the unification of the concepts of mass and energy.

In the discussion above, it has shown that between the macrocosm and the microcosm, between the electromagnetic interactions of atomic scale and the strong interactions of Quark's scale, between the central celestial body and the circling celestial bodies of celestial systems, between and among the large, medium, small, and micro-scales of the earth atmosphere, there also exist laws of conservation of products of spatial physical quantities. Based on this fact, we can further conclude, after considering many other cases, that there might exist a more general law of conservation in terms of structure, in which the informational infrastructure, including time, space, mass, energy, etc., is approximately equal to a constant. In symbols, this conjecture can be written as follows:

$$AT \times BS \times CM \times DE = a \tag{3.32}$$

or more generally,

$$AT^{\alpha} \times BS^{\beta} \times CM^{\gamma} \times DE^{\varepsilon} = a, \tag{3.33}$$

where α, β, γ, ε, and a are constants, T, S, M, E and A, B, C, D are respectively time, space, mass, energy, and their coefficients. These two formulas can be applied to various conservative systems of the universal, macroscopic, and microscopic levels. The constants α, β, γ, ε, and a are determined by the initial state and properties of the natural system of interest.

In Eq. 3.32, when two (or one) terms of choice are fixed, the other two (or three) terms will vary inversely. For example, under the conditions of low speed and the macrocosm, all the coefficients A, B, C, and D equal 1. In this case, when two terms are fixed, the other two terms will be inversely proportional. This end satisfies all principles and various laws of conservation in the classical mechanics, including the laws of conservation of mass, momentum, energy, moment of momentum, etc. So, the varieties of mass and energy in this case are reflected mainly in changes in mass density and energy density. In the classical mechanics, when time and mass are fixed, the effect of a force of a fixed magnitude becomes the effect of an awl when the cross section of the force is getting smaller. When the space and mass are kept unchanged, the same force of a fixed magnitude can have an impulsive effect, since the shorter the time the force acts the greater density the energy release will be. When time and energy are kept the same, the size of working space and the mass density are inversely proportional. When the mass is kept fixed, shrinking acting time and working space at the same time can cause the released energy density reaching a very high level.

Under the conditions of relativity theory, that is, under the conditions of high speeds and great amounts of masses, the coefficients in Eq. 3.32 are no longer equal to 1, and Eq. 3.33 becomes more appropriate, and the constants A, B, C, D, and a and the exponents α, β, γ, and ε satisfy relevant equations in relativity theory. When time and space are fixed, the mass and energy can be transformed back and forth according to the well-known mass-energy relation:

$$E = mc^2.$$

When traveling at a speed close to that of light, the length of a pole will shrink when the pole is traveling in the direction of the pole and any clock in motion will become slower. When the mass is sufficiently great, light and gravitation deflection can be caused. When a celestial system evolves to its old age, gravitation collapse will appear and a black hole will be formed. We can imagine based on Eq. 3.32 that when our earth evolves sufficiently long, say a billion or trillion years, the relativity effects would also appear. More specifically speaking, in such a great time measurement, the creep deformation of rocks could increase and solids and fluids would have almost no difference so that solids could be treated as fluids. When a universe shrinks to a single point with the mass density infinitely high, a universe explosion of extremely high energy density could appear in a very short time period. So, a new universe is created!

3.2.5 *Impacts of the Conservation Law of Informational Infrastructure*

If the perceived law of conservation of informational infrastructure holds true, (all the empirical data, as presented earlier, seem to suggest so), its theoretical and practical significance is obvious.

The hypothesis of the law of conservation of informational infrastructure contains the following facts:

1. Multiplications of relevant physical quantities in either the universal scale or the microscopic scale approximately equal a fixed constant; and
2. Multiplications of either electromagnetic interactions or strong interactions approximately equal a fixed constant.

In the widest domain of human knowledge of our modern time, this law of conservation deeply reveals the structural unification of different layers of the universe so that it might provide a clue for the unification of the four basic forces in physics. This law of conservation can be a new evidence for the big bang theory. It supports the model for the infinite universe with border and the oscillation model for the evolution of the universe, where the universe evolves as follows:

$$\ldots \rightarrow \text{explosion} \rightarrow \text{shrinking} \rightarrow \text{explosion} \rightarrow \text{shrinking} \rightarrow \ldots$$

It also supports the hypothesis that there exist universes "outside of our universe". The truthfulness of this proposed law of conservation is limited to the range of "our universe", with its conservation constant being determined by the structural states of the initial moment of "our universe".

All examples employed earlier show that to a certain degree, the proposed law of conservation holds true. That is, there indeed exists some kind of uniformity in terms of time, space, mass, and energy among different natural systems of various scales under either macroscopic or microscopic conditions or relativity conditions. Therefore, there might be a need to reconsider some classical theoretical systems so that our understanding about nature can be deepened. For example, under the time and space conditions of the earth's atmosphere, the traditional view in atmospheric dynamics is that since the vertical velocity of each atmospheric huge scale system is much smaller than its horizontal velocity, the vertical velocity is ignored. As a matter of fact (Ren and Nio 1994), since the atmospheric density difference in the vertical direction is far greater than that in the horizontal direction, and since the gradient force of atmospheric pressure to move the atmospheric system 10 m vertically is equivalent to that of moving the system 200 km horizontally, the vertical velocity should not be ignored. The law of conservation of informational infrastructure, which holds true for all scales used in the earth's atmosphere, might provide conditions for a unified atmospheric dynamics applicable to all atmospheric systems of various scales. As a second example, in the situation of our earth where time and mass do not change, in terms of geological time measurements (sufficiently long time), can we imagine the force, which causes the earth's crust movements? Does it have to be as great as what is believed currently?

As for applications of science and technology, tremendous successes have been made in the macroscopic and microscopic levels, such as shrinking working spatial sectors, shortening the time length for energy releasing, and sacrificing partial masses (say, the usage of nuclear energy). However, the law of conservation of informational infrastructure might very well further the width and depth of applications of science and technology. For example, this law of conservation can provide a theory and thinking logic for us to study the movement evolution of the earth's structure, the source of forces or structural information which leads to successful predictions of major earthquakes, and to find the mechanisms for the formation of torrential rains and for the arrival of earthquakes (Ren 1996).

Philosophically speaking, the law of conservation of informational infrastructure indicates that in the same way as mass, energy is also a characteristic of physical entities. Time and space can be seen as the forms of existence of physical entities with motion as their basic characteristics. This law of conservation connects time, space, mass, and motion closely into an inseparable whole. So, time, space, mass, and energy can be seen as attributes of physical entities. With this understanding, the concept of mass is generalized and the wholeness of the world is further proved and the thoughts of never diminishing mass and never diminishing universes are evidenced.

3.3 Silent Human Communications

In this section, we will look at how the systemic yoyo model is manifested in different areas of life by briefly visiting relevant experimental and clinical evidences. All the omitted details can be found in the relevant references.

Based on the systemic yoyo model, each human being is a three-dimensional realization of a spinning yoyo structure of a certain dimension higher than three. To illustrate this end, let us consider two simple and easy-to-repeat experiments.

3.3.1 Experiment #1: Feel the Vibe

Let us imagine we go to a sport event, say a swim meet. Assume that the area of competition contains a pool of the Olympic size and along one long side of the pool there are about 200 seats available for spectators to watch the swim meet. The pool area is enclosed with a roof and walls all around the space.

Now, let us physically enter the pool area. What we find is that as soon as we enter the enclosed area of competition, we immediately fall into a boiling pot of screaming and jumping spectators, cheering for their favorite swimmers competing in the pool. Now, let us pick a seat a distance away from the pool deck anywhere in the seating area. After we settle down in our seat, let us purposelessly pick a voluntary helper standing or walking on the pool deck for whatever reason, either for her beauty or for his strange look or body posture, and stare at him intensively. Here is what will happen next:

Magically enough, before long, our stare will be felt by the person from quite a good distance; she/he will turn around and locate us in no time out of the reasonably sized and boiling audience.

By using the systemic yoyo model, we can provide one explanation for why this happens and how the silent communication takes place. In particular, each side, the person being stared at and us, is a high-dimensional spinning yoyo. Even though we are separated by space and possibly by informational noise, the stare of one party on the other has directed that party's spin field of the yoyo structure into the spin field of the yoyo structure of the other party. Even though the later party initially did not know the forthcoming stare, when her/his spin field is interrupted by the sudden intrusion of another unexpected spin field, the person surely senses the exact direction and location where the intrusion is from. That is the underlying mechanism for the silent communication to be established.

When this experiment is done in a large auditorium where the person being stared at is on the stage, the afore-described phenomenon does not occur. It is because when many spin fields interferes the field of a same person, these interfering fields actually destroy their originally organized flows of materials and energy so that the person who is being stared at can only feel the overwhelming pressure from the entire audience instead of from individual persons.

This easily repeatable experiment in fact has been numerously conducted by some of the high school students in our region. When these students eat out in a restaurant and after they run out of topics to gossip about, they play the game they call "feel the vibe". What they do is to stare as a group at a randomly chosen guest of the restaurant to see how long it takes the guest to feel their stares. As described in the situation of swim meet earlier, the chosen guest can almost always feel the stares immediately and can locate the intruders in no time.

3.3.2 Experiment #2: She Does Not Like Me!

In this case, let us look at the situation of human relationship. When an individual A has a good impression about another individual B, magically, individual B also has a similar and almost identical impression about A. When A does not like B and describes B as a dishonest person with various undesirable traits, it has been clinically proven in psychology that what A describes about B is exactly who A is himself (Hendrix 2001).

Once again, the underlying mechanism for such a quiet and unspoken evaluation of each other is based on the fact that each human being stands for a high-dimensional spinning yoyo and its rotational field. Our feelings toward each other are formed through the interactions of our invisible yoyo structures and their spin fields. So, when person A feels good about another person B, it generally means that their underlying yoyo structures possess the same or very similar attributes, such as spinning in the same direction, both being either divergent or convergent at the same time, both having similar intensities of spin, etc. When person A does not like B and lists many undesirable traits B possesses, it fundamentally stands for the situation that the underlying yoyo fields of A and B are fighting against each other in terms of either opposite spinning directions, or different degrees of convergence, or in terms of other attributes. For a more in-depth analysis along a line similar to this one, please consult with Part 4: The Systemic Yoyo Model: Its Applications in Human Mind, of this book.

Such quiet and unspoken evaluations of one another can be seen in any working environment. For instance, let us consider a work situation where quality is not and cannot be quantitatively measured, such as a teaching institution in the USA. When one teacher does not perform well in his line of work, he generally uses the concept of quality loudly in day-to-day settings in order to cover up his own deficiency in quality. When one does not have honesty, he tends to use the term honesty all the time. It is exactly as what Lao Tzu (exact time unknown, Chap. 1) said over 2,000 years ago: "The one who speaks of integrity all the time does not have integrity".

When we tried to repeat this experiment with local high school students, what is found is that when two students A and B, who used to be very good friends, turned away from each other, we ask A why she does not like B anymore. The answer is exactly what we expect: "Because she does not like me anymore!"

By revisiting Bjerknes's Circulation Theorem, it is found that any force acting on a fluid must be a twisting force, creating spinning currents in the fluid. Other than land−ocean breezes this theorem can explain, it also implies that (mathematical) nonlinearity means eddy sources and in turn eddy motions. This theorem actually provides a theoretical explanation for why the mostly seen form of motion in the universe is rotation, since uneven densities lead directly to eddy sources. And, because of the duality of eddies in their rotational directions, the initial smooth fields, if any, have to be destroyed. This end explains why there must be matters and phenomena theories developed on the assumption of smoothness cannot explain.

Based on different versions of the concept of (general) systems, the law of conservation of informational infrastructure is introduced, providing another vivid evidence for the physical existence of systemic yoyo structures behind systems. And, in the last section of this chapter, easily repeatable observations in social settings are analyzed in the name of the systemic yoyo model. These experiments clearly prove the validity of the systemic yoyo model in areas of sociology and humanities.

Chapter 4
Elementary Properties of Systemic Yoyos

To prepare the theoretical foundation for the rest of this book, in this chapter, based on the basic attributes of the yoyo model, we introduce the structure of meridian fields that helps to hold the dynamic spin field of the yoyo model together. With the spin field of a systemic yoyo structure fully established, we establish various properties of general systems, which will soon be fully employed in the following chapters in the investigation of social organizations of different scales from civilizations, the largest forms of human organizations, to individuals, the smallest units of social organizations.

In particular, in Sect. 4.1, we develop the concept of meridian fields for systemic yoyos. Based on the well-known three-jet events, as well observed and documented in the research of particle physics, as the supporting evidence the quark structure of systemic yoyos is established. After that, we learn how to apply the concepts of eddy and meridian fields and Hide's (1953) dishpan experiment to provide a plausible explanation for how and why throughout the history, geomagnetic poles of the Earth have reversed their directions numerous times, and why there is an inclination between the geomagnetic axis and that of the Earth's rotation.

In Sect. 4.2, we focus on the study of interactions between systemic yoyos. It is shown that yoyo fields possess such similar properties as the magnetic fields that like fields repulse and opposite polarities attract. In terms of how systemic yoyos would interact to each other, it is shown that yoyo structures of similar scales have the tendency to line up their axes of rotation parallel to each other. When one yoyo structure is huge when compared to another one, the small structure tends to realign its polarities to those of the large structure due to the influence of the intense and powerful field of the large yoyo. Through analyzing the interactions between systemic yoyos, we will learn how to generalize Lenz' Law, which was initially established in the research of electromagnetism, so that the generalized form can be readily applied to the study of various social phenomena. Also, the phenomenon of yoyo dipoles and possible ways for yoyo fields to combine through their meridian fields are considered.

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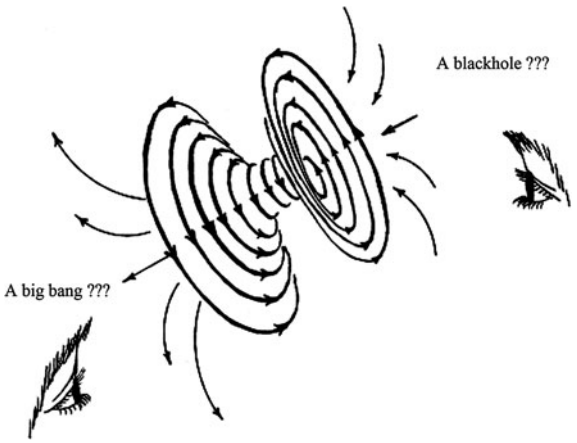

Fig. 4.1 Eddy motion model of a general system

In Sect. 4.3, we look at how Newton's laws of motion, which have helped to make physics an "exact" science, can be generalized to the scenario of general systems. Following that, the current chapter is concluded with a discussion on the validity of figurative analysis.

4.1 Eddy and Meridian Fields

With the yoyo model established in the previous chapters both theoretically and empirically, we now look at some additional, detailed structure of such a general systemic model.

4.1.1 The Field Structure

Because each yoyo spins as in Fig. 4.1, other than the spin field, the field that is perpendicular to the axis of rotation of the yoyo structure as shown in Fig. 4.1, there also exists a meridian field accompanying each yoyo (see Fig. 4.2). The invisible meridians go into the center of the black hole, through the narrow neck, and then out the big bang. They travel through the space and return to the center of the black hole. Somehow we can imagine that these meridians help to hold different layers of the spin field of the yoyo structure together.

Here, the word "spin" is used to capture the concept of angular momentum or the presence of angular momentum intrinsic to a body as opposed to orbital angular momentum of angular momentum that is the movement of the object about an external point. For example, the spin of the earth stands for the earth's daily rotation about its polar axis. The orbital angular momentum of the earth is about

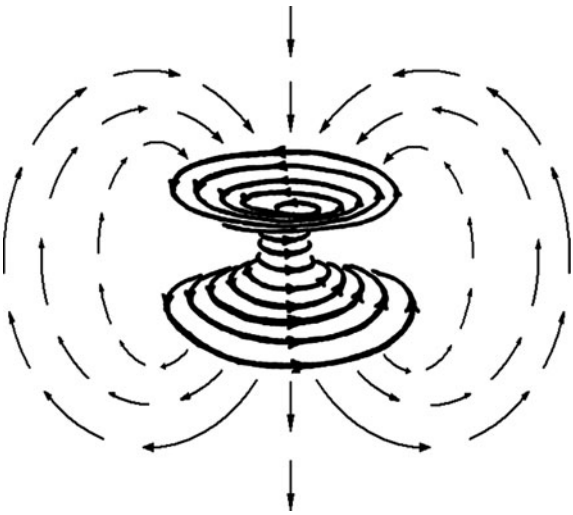

Fig. 4.2 The distribution of a meridian field

the earth's annual movement around the sun. In general, a two-dimensional object spins around a center (or a point), while a three-dimensional object rotates around a line called an axis. Here, the center and the axis must be within the body of the object.

Mathematically, the spins of rigid bodies have been understood quite well. If a spin of a rigid body around a point or axis is followed by a second spin around the same point (respectively axis), a third spin results. The inverse of a spin is also a spin. Thus, all possible spins around a point (respectively axis) form a group of mathematics. However, a spin around a point or axis and a spin around a different point (respectively axis) may result in something other than a rotation, such as a translation. Spins around the *x*-, *y*-, and *z*-axes in the three-dimensional Euclidean space are called principal spins. Spin around any axis can be performed by taking a spin around the *x*-axis, followed by a spin around the *y*-axis, and then followed by a spin around the *z*-axis. That is, any three-dimensional spin can be decomposed into a combination of principal spins.

In astronomy, spin (or rotation) is a commonly observed phenomenon. Stars, planets, galaxies all spin around on their axes. The speeds of spin of planets in the solar system were first measured by tracking visible features. This spin induces a centrifugal acceleration, which slightly counteracts the effect of gravity and the phenomenon of precession, a slight "wobble" in the movement of the axis of a planet.

In social science areas, spin appears in the study of many topics. That is why we have the old saying: Things always "go around and come around." As an example, the theory and practice of public relations heavily involve the concept of spin, where a person, such as a politician, or an organization, such as a publicly traded company, signifies his often biased favor of an event or situation. While traditional public relations may rely on creative presentation of the underlying facts, "spin"

tends to imply disingenuous, deceptive, and/or highly manipulative tactics used to influence public attitudes and opinions (Stoykov and Pacheva 2005; Bernays 1945).

In quantum mechanics, spin is particularly important for systems at atomic length scales, such as individual atoms, protons, or electrons. Such particles and the spin of quantum mechanical systems possess unusual or non-classical features. For such systems, spin angular momentum cannot be associated with the concept of rotation precisely, but instead, refers to the presence of angular momentum (Griffiths 2004).

So, each yoyo structure contains spins of materials in two perpendicular directions. The spin field perpendicular to the axis of rotation of the entire structure is referred to as the eddy field and the other field, which is quasi-parallel to the axis, is named the meridian field. For the convenience of our communication, for any given yoyo structure, the black hole side will be referred to as the south pole of the structure and the big bang side the north pole.

Also, in theory, we can think of the totality of all materials that can be physical, tangible, intangible, or epistemological and that are contained in a systemic yoyo, if this yoyo is situated in isolation from other yoyo structures. So, the concept of mass for a systemic yoyo can be defined as in the conventional physics. Since systems are of various kinds and scales, the universe can be seen as an ocean of eddy pools of different sizes, where each pool spins about its visible or invisible center or axis. At this junction, one good example in our three-dimensional physical space is the spinning field of air in a tornado. In the solenoidal structure, at the same time when the air within the tornado spins about the eye in the center, the systemic yoyo structure continuously sucks in and spits out air. In the spinning solenoidal field, the tornado takes in air and other materials, such as water or water vapor on the bottom, lifts up everything it took into the sky, and then it continuously spays out the air and water from the top of the spinning field. At the same time, the tornado also breathes in and out with air in all horizontal directions and elevations. If the amounts of air and water taken in by the tornado are greater than those given out, then the tornado will grow larger with increasing effect on everything along its path. That is the initial stage of formation of the tornado. If the opposite holds true, then the tornado is in its process of dying out. If the amounts of air and water that are taken in and given out reach an equilibrium, then the tornado can last for at least a while. In general, each tornado (or a systemic yoyo) experiences a period of stable existence after its initial formation and before its disappearance.

Similarly, for the general systemic yoyo model, it also constantly takes in and spits out materials. For the convenience of our discussion in this book, we assume that the spinning of the yoyo structures follows the left-hand rule 1 below:

Left-Hand Rule 1: When holding our left hand, the four fingers represents the spinning direction of the eddy plane and the thumb points to the north pole direction along which the yoyo structure sucks in and spits out materials at its center (the narrow neck) (Note: It can be seen that in the physical world, systemic yoyos do not have to comply with this left hand rule).

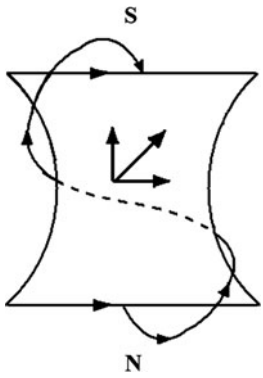

Fig. 4.3 Slanted meridians of a yoyo structure

As influenced by the eddy spin, the meridian directional movement of materials in the yoyo structure is actually slanted instead of being perfectly vertical. In Fig. 4.3, the horizontal vector stands for the direction of spin on the yoyo surface toward the reader and the vertical vector the direction of the meridian field, which is opposite of that in which the yoyo structure sucks in and spits out materials. Other than breathing in and out materials from the black hole (the south pole) and big bang (the north pole) sides, the yoyo structure also takes in and gives out materials in all horizontal directions and elevations, just as in the case of tornadoes discussed earlier.

In the process of taking in and giving out materials, formed is an outside surface of materials that is mostly imaginary of our human mind; this surface holds most of the contents of the spinning yoyo. The density of materials of this surface decreases as one move away from the yoyo structure. The maximum density is reached at the center of the eddy field. As the spin field, which is the combination of the eddy and meridian fields, constantly takes in and gives out materials, there does not exist any clear boundary between the yoyo structure and its environment, which is analogous to the circumstance of a tornado that does not have a clear-cut separation between the tornado and its surroundings.

4.1.2 The Quark Structure of Systemic Yoyos

To make our presentation complete, let us first look at a well-known laboratory observation from particle physics. The so-called three-jet event is an event with many particles in a final state that appear to be clustered in three jets, each of which consists of particles that travel in roughly the same direction. One can draw three cones from the interaction point, corresponding to the jets, Fig. 4.4, and most particles created in the reaction appear to belong to one of these cones. These three-jet events are currently the most direct available evidence for the existence of gluons, the elementary particles that cause quarks to interact and are indirectly

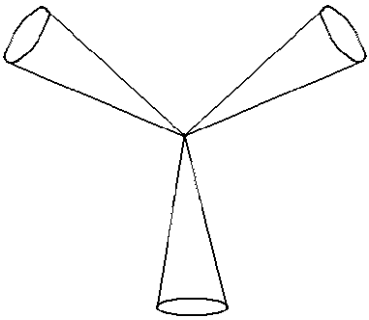

Fig. 4.4 A "snapshot" in time and two spatial dimensions of a three-jet event

responsible for the binding of protons and neutrons together in atomic nuclei (Brandelik et al. 1979). Because jets are ordinarily produced when quarks hadronize, the process of the formation of hadrons out of quarks and gluons, and quarks are produced only in pairs, an additional particle is required to explain such events as the three-jets that contain an odd number of jets. Quantum chromodynamics indicates that this needed particle of the three-jet events is a particularly energetic gluon, radiated by one of the quarks, which hadronizes much as a quark does. What is particularly interesting about these events is their consistency with the Lund string model. And, what is predicted out of this model is precisely what is observed.

Now, let us make use of this laboratory observation (the three-jet events) to study the structure of systemic yoyos. To this end, let us borrow the term of quark structure from (Chen 2007), where it is argued that each microscopic particle is a whirltron, a similar concept as that of systemic yoyos.

Out of the several hundreds of different microscopic particles, other than protons, neutrons, electrons, and several others, most only exist momentarily. That is, it is a common phenomenon for general systemic yoyos to be created and to disappear constantly in the physical microscopic world. According to (Chen 2007, p 41) all microscopic systemic yoyos can be classified on the basis of laboratory experiments into two classes using the number of quarks involved. One class contains 2-quark yoyos (or whirltrons), such as electrons, π-, κ-, η-mesons, and others; and the other class 3-quark yoyos (whirltrons), including protons, neutrons, Λ-, Σ-, Ω-, Ξ (Xi) baryons, etc. Here, electrons are commonly seen as whirltrons without any quark. However, Chen (2007) showed that yes, they are also 2-quark whirltrons. Currently, no laboratory experiment has produced 0-quark or n-quark whirltrons, for natural number $n \geq 4$. For the completeness of this presentation, let us rewrite Chen's (2007) argument for why electrons have two quarks here using the yoyo structures.

Following the notations of (Chen 2007), each spinning yoyo, as shown in Fig. 4.1, is seen as a 2-quark structure, where we imagine the yoyo is cut through its waist horizontally in the middle, then the top half is defined as an absorbing quark and the bottom half a spurting quark. Now, let us study 3-quark yoyos by looking at a proton P and a neutron N. At this junction, the three-jet events are

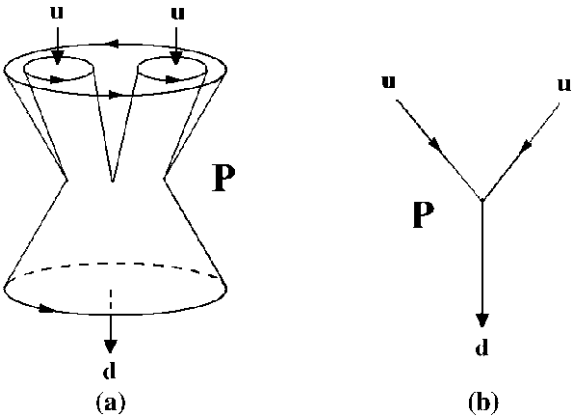

Fig. 4.5 The quark structure of a proton P

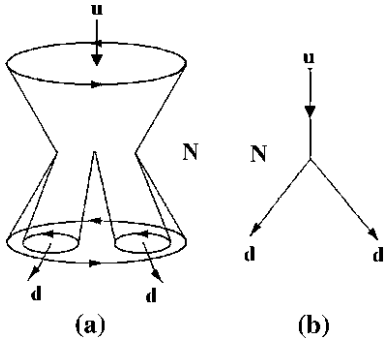

Fig. 4.6 The quark structure of a neutron N

employed as the evidence for the structure of 3-quark yoyos, where there are two absorbing and one spurting quarks in the eddy field. The proton P has two absorbing u-quarks and one spurting d-quark (Fig. 4.5), while the neutron N has two spurting d-quarks and one absorbing u-quark (Fig. 4.6). In these figures, the graphs (b) are the simplified flow charts with the line segments indicating the imaginary axes of rotation of each local spinning column. Here, in Fig. 4.5, the absorbing u-quarks stand for local spinning pools while together they also travel along in the larger eddy field in which they are part of. Similarly in Fig. 4.6, the spurting d-quarks are regional spinning pools. At the same time when they spin individually, they also travel along in the large yoyo structure of the neutron N. In all these cases, the spinning directions of these u- and d-quarks are the same except that each u-quark spins convergently (inwardly) and each d-quark divergently (outwardly).

Different yoyo structures have different numbers of absorbing u-quarks and d-quarks. And, the u-quarks and d-quarks in different yoyos are different due to variations in their mass, size, spinning speed and direction, and the speed of absorbing and spurting materials. This end is well supported by the discovery of quarks of various flavors, two spin states (up and down), positive and negative

charges, and colors. That is, the existence of a great variety of quarks has been firmly established.

Now, if we fit Fultz's dishpan experiment to the discussion above by imagining both the top and the bottom of each yoyo as a spinning dish of fluids, then the patterns as observed in the dishpan experiment suggest that in theory, there could exist such a yoyo structure that it has n u-quarks and m d-quarks, where $n \geq 1$ and $m \geq 1$ are arbitrary natural numbers, and each of these quarks spins individually and along with each other in the overall spinning pool of the yoyo structure.

From discussions in (Lin 2007, 2008b), it can be seen that due to uneven distribution of forces, either internal or external to the yoyo structure, the quark structure of the spinning yoyo changes, leading to different states in the development of the yoyo. This end can be well seen theoretically and has been well supported by laboratory experiments, where, for example, protons and neutrons can be transformed into each other. When a yoyo undergoes changes and becomes a new yoyo, the attributes of the original yoyo in general will be altered. For example, when a 2-quark yoyo is split into two new yoyos under an external force, the total mass of the new yoyos might be greater or smaller than that of the original yoyo. And, in one spinning yoyo, no matter how many u-quarks (or d-quarks) exist, although these quarks spin individually, they also spin in the same direction and at the same angular speed. Here, the angular speeds of u-quarks and d-quarks do not have to be the same, which is different of what is observed in the dishpan experiment, because in this experiment everything is arranged with perfect symmetry, such as the flat bottom of the dish and perfectly round periphery.

4.1.3 The Flips of Geomagnetic Poles

If the yoyo in Fig. 4.1 models, say, our earth, where the three-dimensional earth ball is a physical realization of this multi-dimensional yoyo, then the spin field of the big bang side corresponding to the visible earth and the black hole side, the invisible side of earth. With this identification in place, one explanation of the meridian field of the yoyo is the earthly geomagnetic field, which is approximately a magnetic dipole. One pole of it is located near the North Pole, and the other near the geographic South Pole. And the imaginary line joining the geomagnetic poles is inclined by approximately 11.3° from the planet's axis of rotation. The geomagnetic field extends several tens of thousands of kilometers into space as the magnetosphere (Walt 2005; Comins 2006).

The cause of the geomagnetic field for a celestial body has been explained by the so-called dynamo theory (Campbell 2001). The theory attempts to describe the process through which motions of a conductive body in the presence of a magnetic field acts to regenerate that magnetic field. It has been used to explain the presence of anomalously long-lived magnetic fields in astrophysical bodies. In these bodies, dynamo action depends on the existence of highly conductive fluids, such as the earth's liquid iron contained in the outer core, or the ionized gas of the sun.

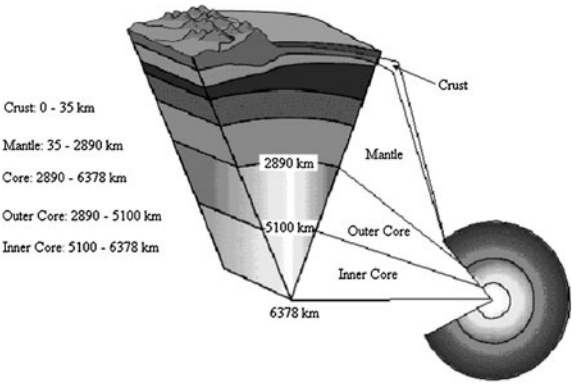

Fig. 4.7 A look at the inside of the Earth

By using magneto-hydrodynamic equations, the dynamo theory of astrophysical bodies investigates how the flow of the conducting materials in the interior of an object can continuously regenerate the magnetic fields of planetary and stellar bodies. In the case of the earth, the geomagnetic field is believed to be caused by the convection of molten iron and nickel contained within the outer core along the Coriolis effect caused by the Earth's rotation. When conducting fluid flows across an existing magnetic field, electric currents are induced, creating another magnetic field. When this magnetic field reinforces the original magnetic field, a dynamo is created, which sustains itself.

One problem with this dynamo theory approach is: where is the initial existing magnetic field from in order to create the needed dynamo to sustain the already existing magnetic field? The yoyo model with its meridian field does not require such a preexisting magnetic field for the underlying body to possess its meridian field. That is, the earth's magnetic field exists as part of its natural rotation. The 11.3^{o} inclination from the planet's axis of rotation is caused by the imperfect spherical shape of the solid core. To this end, let us use the dishpan experiment (Hide 1953; Fultz et al. 1959) to elaborate and to explain why the geomagnetic poles reverse themselves frequently over time.

To help make the point clear, let us first look at the earth's internal structure (by depth below surface): 0–35 km-the crust, 35–2,890 km-the mantle, 2,890–6,378 km-the core, The core is divided into the outer core from the depth 2,890 to 5,100 km, and the inner core from the depth of 5,100 km-to that of 6,378 km, Fig. 4.7. The core is largely made up of iron (80%) along with nickel and one or more light elements. Seismic measurements show that the core is divided into two parts: a solid inner core (Lehmann 1936) with a radius of about 1,200 km and a liquid outer core extending beyond the inner core to a radius of about 3,480 km. The liquid outer core surrounds the inner core and is composed of iron mixed with nickel and trace amounts of lighter elements. Beyond the belief that the convection in the outer core causes the Earth's magnetic field (see above), it is also believed that the solid core is too hot to hold a permanent magnetic field but probably acts to stabilize the magnetic field generated by the liquid outer core.

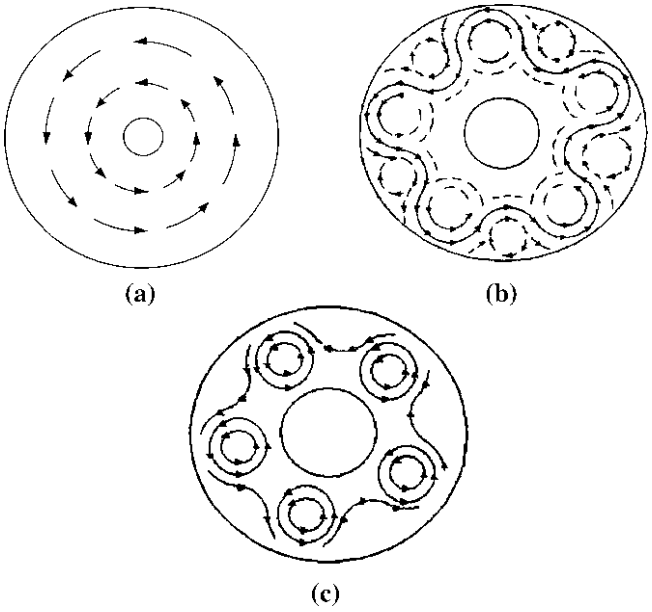

Fig. 4.8 Patterns observed in Hide's dishpan experiment **a** Symmetric flow at the upper surface **b** Asymmetric flow at the upper surface **c** Asymmetric circular flow at the upper surface

To fit the current scenario and to make our present locally complete, let us briefly describe Hide's (1953) dishpan experiment. In 1953, Hide used two concentric cylinders with a liquid placed in the ring-shaped region between the cylinders. He placed the container on a rotating turntable subjected to heating near the periphery and cooling at the center. The turntable generally rotated counter clockwise, as does the earth when viewed from above the North Pole. Even though everything in the experiment was arranged with perfect symmetry about the axis of rotation, such as no impurities added in the liquid, the bottom of the container is flat, Hide observed the flow patters as shown in Fig. 4.8. Briefly, with fixed heating, a transition from circular symmetry (Fig. 4.8a) to asymmetries (Fig. 4.8b), then Fig. 4.8c would take place as the rotation increased past a critical value. With sufficiently rapid but fixed rate of rotation, a similar transition would occur when the heating reached a critical strength, while another transition back to symmetry would occur when the heating reached a still higher critical strength. Also, in stage Fig. 4.8c, a chain of identical eddy motions would appear. As they travel along, they would alter their shapes in unison in a regular periodic fashion, and after many rotations of the turntable, they would regain their original shape and then repeat the cycle.

What's important about this experiment is that structures, such as jet streams, traveling vortices, and fronts, appear to be basic features in rotating heated fluids.

Now, let us see how we can use the yoyo model in Fig. 4.1 and the Hide's (1953) dishpan experiment to provide an explanation for:

1. The 11.3° inclination from the Earth's axis of rotation (In fact, the geomagnetic poles move in various ways, in ellipses and in a random motion over eons).
2. Why the geomagnetic poles switch places (and reverse themselves) frequently over time.

In Hide's experiment, let us identify the smaller, inner cylinder as the Earth's solid core, and the larger, outer cylinder as the outer boundary of the Earth's liquid outer core. The observed liquid patterns in Fig. 4.8 are caused by uneven distribution of spinning forces acting on the liquid particles located in different distances from the solid core. Here, either the temperature difference between the center and the periphery or the increased speed of rotation strengthens the uneven distribution of the twisting forces acting on the liquid. The observed regular period of transition of flow patterns is determined by the perfect symmetry of the liquid (no impurities) and the cylinders about the axis of rotation. Now, since the earthly boundary conditions, the shape of the solid core, and the shape of the outer edge of the liquid outer core, are not perfectly symmetric with respect to its axis of rotation, the orientation of the circular eddy motions in Fig. 4.8b, c would not be perfectly in line with the axis of the Earthly rotation. This fact explains why the geomagnetic poles move in various ways and have an inclination from the Earth's axis of rotation (so that this inclination should also change over time). Also, this fact provides us a means to study the shape of the solid core by carefully analyzing the traces of the geomagnetic North and the South Poles.

As for geomagnetic pole reversals, they would appear at the moment when the liquid in the outer core flows relatively symmetrically and uniformly with respect to the center of rotation (Fig. 4.8a). At this moment, the geomagnetic field is the weakest, since no subeddy exists to create additional geomagnetic forces; and since the solid core rotates slightly faster than the rest of the planet (Zhang et al. 1995; for over a period of 700–1,200 years, the inner core appears to make one full extra spin), the uneven distribution of spinning forces acting on the liquid particles located at different distances from the inner core might reverse from that as shown in Fig. 4.8b, c. So, consequently, the chain of identical eddy motions (in Fig. 4.8b, c) formed in the outer core would be spinning in the opposite direction. Such direction change in the subeddies will reverse the geomagnetic poles. Because of the imperfect shapes of the outer and inner cores, and the influences from other celestial bodies on the Earth, the reversals of geomagnetic poles have seemed to be random. The yoyo model also explains why geomagnetic field reversals most likely to occur when the strength of the field at the earth's surface is the lowest because that is when the liquid in the outer core flows relatively evenly and symmetrically with respect to the center of rotation (Fig. 4.8a) without any existing eddy leaf as shown in Fig. 4.8b, c.

4.2 Interactions Between Systemic Yoyos

When more than two yoyo structures are concerned with, the interactions between these entities, a multi-body problem, become impossible to describe analytically. This end is witnessed by the difficulties scholars have faced in the investigation of the three-body problem since about 300 years ago when Newton introduced his laws of motion regarding two-body systems. So, to achieve anything meaning in terms of the interactions between systemic yoyos, in this section, we will focus on figurative expressions.

4.2.1 Classification of Yoyo Fields

Just as electric or magnetic fields, where like fields, such a positive (or negative) electric fields and the S (or N) poles of magnets, repel each other and opposite fields attract, for yoyo fields, the same principle holds true, where the like-kind ends (the north poles or south poles) repel and the opposite attract. In particular, when the south poles of two yoyos face each other, Fig. 4.9a, where S stands for the black hole side and N the big bang side, although the two south poles have the tendency to attract each other, the meridian fields X and Y actually repel each other apart, where m_{X_1} repels against m_{Y_1} and m_{X_2} against m_{Y_2}. So, in this case, there does not exist any attraction between the two black hole sides, since these S sides cannot feed anything to each other directly, and both have to get input materials from their meridian fields. When the north poles of yoyos X and Y face off (head on), Fig. 4.9b, the yoyos are pushed apart, where in comparison the meridian fields of X and Y only come into place with attraction when the edges of the north pole sides of X and Y directly face each other. When the south poles of a yoyo faces the north pole of another yoyo (Fig. 4.10a), where what is spurted out of yoyo Y can go and do go directly into yoyo X. At the same time, the meridian fields of both yoyos X and Y have the tendency to combine into one field too (Fig. 4.10b).

The yoyo's (vertical) absorbing/spurting and (all directional) taking in/giving out along the meridian field direction create an active field that can be visibly seen as a field with source (or active field). In the physical world, gravitational fields, magnetic fields, electric fields, and nuclear fields are some of the examples of both active fields and eddy fields. In particular, in a given yoyo, if its eddy field is identified as its magnetic field, then the active (the meridian) field will correspond to the electric field. In this case, the so-called N and S poles of the magnetic field correspond respectively to the diverging and the converging sides of the yoyo structure, while the positive and negative electric fields to the converging and diverging eddy fields. Similarly, the eddy field can be identified as an electric field and so correspondingly the meridian field as the magnetic field. Now, if the eddy field is seen as a gravitational field, then the meridian field will be the

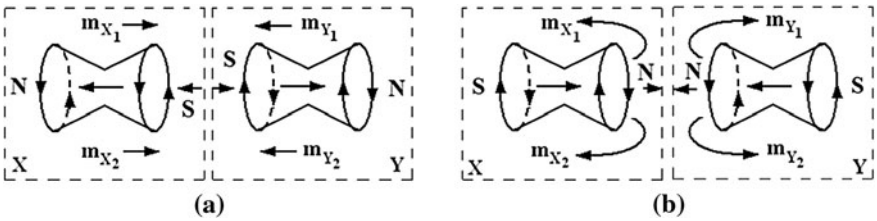

Fig. 4.9 Repulsion of like yoyo fields

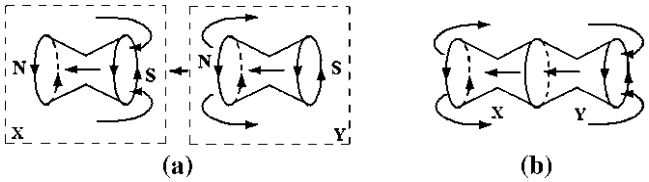

Fig. 4.10 How two yoyos can potentially become one yoyo

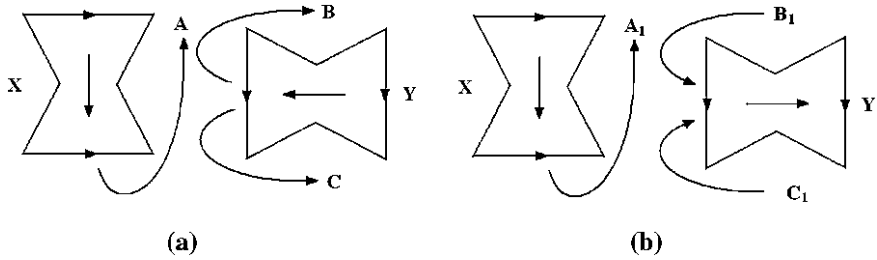

Fig. 4.11 The tendency for yoyos to line up

corresponding magnetic field. In this case, we can see that the gravitational field can be both attraction and repulsion that exist side by side, the former corresponds to the converging side of the eddy field, and the later the diverging side. From this discussion, it can be seen that all forms of fields must have two opposite effects, such as the N and S poles of a magnetic field, where the opposite effects have to coexist at all times and no one side effect can exist without the other opposite effect, even though the opposite effects do not have to be visible at the same time or both of them do not have to be visible at all.

Now, let us look at the relative positioning of two yoyo structures. Assume that two spinning yoyos X and Y are given as shown in Fig. 4.11. Then the meridian field A of X fights against C of Y so that both X and Y have the tendency to realign themselves in order to reduce the conflicts along the meridian directions. Similarly in Fig. 4.11b, the meridian field A_1 of yoyo X fights against B_1 of Y. So, the yoyos X and Y also have the tendency to realign themselves as in the previous case.

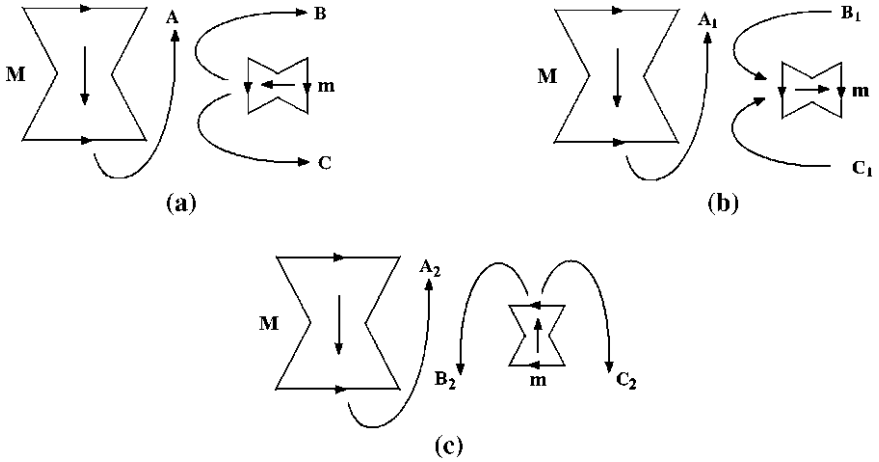

Fig. 4.12 How mighty spinning yoyo M bullies particle yoyo m

Of the two yoyos X and Y above, let us assume that one of them is mighty and huge and the other so small that it can be seen as a tiny particle. Then, the tiny particle yoyo m will be forced to line up with the much mightier and larger spinning yoyo M in such a way that the axis of spin of the tiny yoyo m is parallel to that of M and that the polarities of m and M face the same direction. For example, Fig. 4.12 shows how the particle yoyo m has to rotate and reposition itself under the powerful influence of the meridian field of the much mightier and larger yoyo structure M. In particular, if the two yoyos M and m are positioned as in Fig. 4.12a, then the meridian field A of M fights against C of m so that m is forced to realign itself by rotating clockwisely in order to reduce the conflicts with the meridian direction A of M. If the yoyos M and m are positioned as in Fig. 4.12b, the meridian field A_1 of yoyo M fights against B_1 of m so that the particle yoyo m is inclined to readjust itself by rotating once again clockwisely. If the yoyos M and m are positioned as in Fig. 4.12c, then the meridian field A_2 of yoyo M fights against B_2 of m so that the tiny particle yoyo m has no choice but to reorient itself clockwisely to the position as in Fig. 4.12b. As what has been just analyzed, in this case, yoyo m will further be rotated until its axis of spin is parallel to that of M and its polarities face the same directions as M.

Now, let us imagine a tiny particle yoyo m, say, an electron in the conductive circuit, or a unit in the supply chain of a business activity, where either the circuit or the supply chain is theoretically seen as the circular loop in Fig. 4.13a, where the X's stand for an overriding yoyo field of the environment going into the page. Then, the axis of spin and its polarities of the tiny yoyo m have to live up with those of an abstract mighty spinning yoyo, part of whose eddy field is symbolized by the X's in Fig. 4.13a.

Based on the Left-Hand Rule 1 and the north direction of the yoyo field outside the circuit or supply chain (the reason why we use the direction outside the circuit

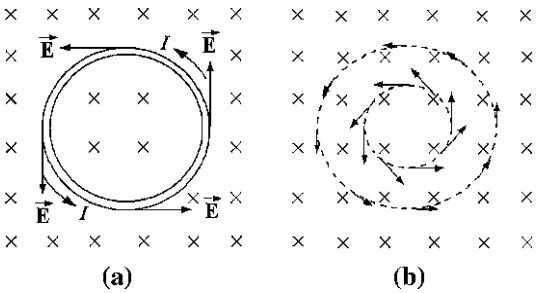

Fig. 4.13 The manifestation of an induced yoyo field

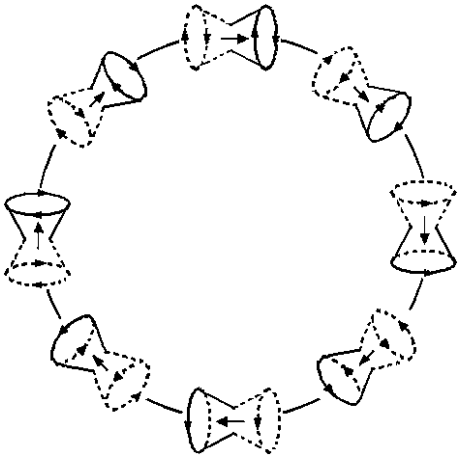

Fig. 4.14 How particle yoyos line up inside the circuit

instead of the inside is because in the eddy field of the mighty spinning yoyo, the circuit would be only the size of a dot), we can see how the particle yoyos, such as electrons or different units in the supply chain, line up inside the circuit as shown in Fig. 4.14. This line up of particle yoyos inside the circuit also determines the north direction of the super positioned magnetic eddy field along the circuit, which fights against the increase in the intensity of the original magnetic yoyo field. This end in fact provides a systems theory support for the validity of the following generalized Lenz's Law, where Lenz's Law is well-known in the theory of electromagnetism.

Generalized Lenz's Law: There is an induced yoyo current in any closed, conducting loop if and only if the yoyo flux that is a yoyo field through the loop is changing. The direction of the induced current is such that its induced yoyo field opposes the change in the yoyo flux.

If we ponder over the discussion above in more details, it is not hard to see that the imaginary return circuit is not necessary. As long as the yoyo field (an eddy or meridian field), as indicated by the X's, changes, there will be a manifested yoyo field in the space (Fig. 4.13b). This kind of manifested yoyo field is a special kind yoyo field.

To make sense out of the generalized Lenz's Law beyond the traditional understanding in the field of electromagnetism, let us imagine a person, he lives in

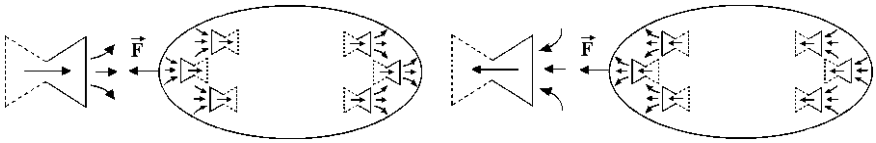

Fig. 4.15 Formation of yoyo dipoles

an established environment. If one day, he suddenly plans to change his own behaviors completely, what will happen to him is that he will find that everyone else in the environment instantly become united in the fight against his planned changes. The more he is determined to carry out his planned changes, the more resistance he will experience from the united environmental front. This example is one case of application of the generalized Lenz's Law in social sciences.

4.2.2 Yoyo Dipoles

Similar to the concept of electric charge, if an object, when seen as a high-dimensional spinning yoyo, possesses an overall attraction pull or repulsion push, we say that the object has a yoyo charge. Now, it is well-known that electrically charged plastic or glass rods can attract certain non-metal insulators, such as scraps of paper. Does this phenomenon indicate certain properties of yoyo charges? As a matter of fact, when a yoyo charge neutral object is affected by an external yoyo charge, the object can experience the phenomenon of polarization, just as the scraps of paper being affected by an electric charge. In particular, when a positive yoyo charge is placed near the object, the negative component yoyos inside the object have the potential to move to the side closer to the positive charge, while positive component yoyos move to the side that is furthest away from the external charge. Similarly, if the external charge is negative, the charged component yoyos inside the object will move in directions opposite to those described above. That is, under the influence of an external powerful yoyo charge, a yoyo dipole can be formed, Fig. 4.15. Because opposite yoyo poles attract, the external yoyo charge attracts the created yoyo dipole.

4.2.2.1 Movement of Yoyo Dipoles in Uniform Yoyo Fields

When a yoyo dipole is situated in an uniform yoyo field $\vec{E}$, its two poles of the dipole will be acted upon by the yoyo field. The acting and reacting forces are of the same magnitudes with opposite directions:

$$\vec{F}_+ = +q\vec{E} \text{ and } \vec{F}_- = -q\vec{E}.$$

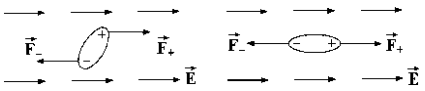

Fig. 4.16 The yoyo dipole experiences a torque

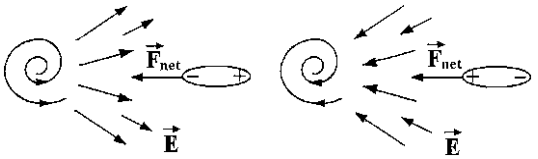

Fig. 4.17 A yoyo dipole in an uneven yoyo field

So, the yoyo dipole experiences a torque (Fig. 4.16) whose net force is $\vec{F}_{\text{net}} = \vec{F}_+ + \vec{F}_- = \vec{0}$.

4.2.2.2 Movement of Yoyo Dipoles in Uneven Yoyo Fields

Assume that we place a yoyo dipole inside an uneven yoyo field $\vec{E}$, where in different locations the field intensities and directions are different. For instance, in the field of a particle yoyo, the yoyo dipole will spin until it is parallel to the direction of the field. If the particle yoyo carries a positive charge, then the positive direction of the yoyo dipole agrees with that of the field. Because the yoyo field intensity is different from one location to another, there is a difference between the forces experienced by the two poles of the yoyo dipole. The end closer to the yoyo charge experiences a pull greater than the push at the end pointing to the positive direction. Therefore, the net force acting on the yoyo dipole is not zero and points to the yoyo charge. If the yoyo charge is negative, similar results hold true (Fig. 4.17). That is, we have the following result:

Fact 4.2.1 The force experienced by a yoyo dipole placed in an uneven yoyo field always points to the direction of greater field intensity.

4.2.3 Combinations of Systemic Yoyos Through Meridian Fields

When systemic yoyos combine through their meridian fields (Fig. 4.18), because these meridian fields have different properties in different directions such that the same poles repel each other and opposite attract, between the opposite poles of two meridian fields, there exists a field potential pit (trap) over which the yoyos attract to each other. At the same time, between the same poles of the meridian fields, a field potential rampart exists to repel the poles from each other. No matter whether it is the field potential pit or rampart, the field intensity is different from one yoyo structure to another. For yoyos of relatively stronger field strengths, their field potential pits are relatively deeper and their potential ramparts are relatively

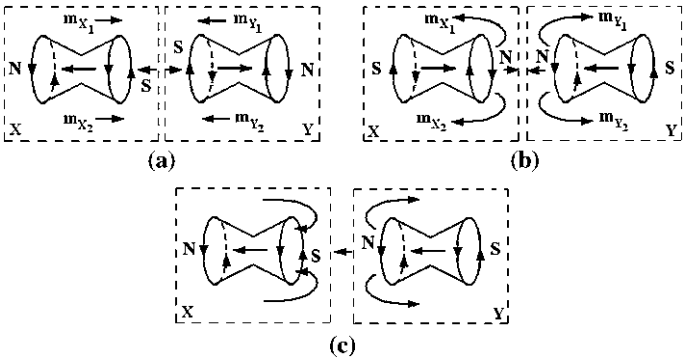

Fig. 4.18 Systemic yoyos combine through their meridian fields

higher, meaning further away from the centers of the yoyo structures; and for yoyos of relatively weaker field strengths, their field potential pits are relatively shallower and their potential ramparts relatively lower. When systemic yoyos link to each other through their meridian fields so that the black hole sides (the south poles) face with their big bang sides (the north poles), their eddy fields also link and interact with each other. For example, in Fig. 4.19 the field structure of a ^{4}He nucleus is shown. This nucleus consists of two protons and two neutrons. Its yoyo structure looks like a large ring along which the protons and neutrons are connected through their quarks. In Fig. 4.19a, the oval arrows stand for the eddy fields' directions of the protons and neutrons, and the line arrows the meridian fields' directions. Because the protons and neutrons are connected through their quarks and their eddy and meridian fields' directions satisfy the Left Hand Rule 1, the ^{4}He nucleus can be depicted well in Fig. 4.19b. In this figure, the horizontal ellipse stands for the loop made up of the protons and neutrons connected through meridian fields and the vertical ellipses the eddy fields of the protons and neutrons.

When spinning yoyos link through their opposite meridian poles, their relative positions will be fixed. So, between these yoyos, a kind of meridian field bond is formed, where the spinning centers lines are connected to each other with the meridian fields pointing to the same direction.

As indicated by Fig. 4.19, each field bond involves parameters such as bond strength, bond angle, bond force, bond length, and bond energy. The so-called bond strength is exactly the field intensity. The stronger the bond strength is, the greater the bond force and the higher the bond energy. Conversely, the weaker the bond strength is, the smaller the bond force and the lower the bond energy. That is, the bond strength is directly proportional to the bond force (and the bond energy). Within the effective range of a yoyo field its field bond possesses elasticity. That is, both bond length and angle can be changed. When the bond length increases, the bond strength, force, and energy decrease.

When the strength of attraction between two opposite meridian fields increase, that is, when the bond length shrinks, the strengths of repulsion between the same

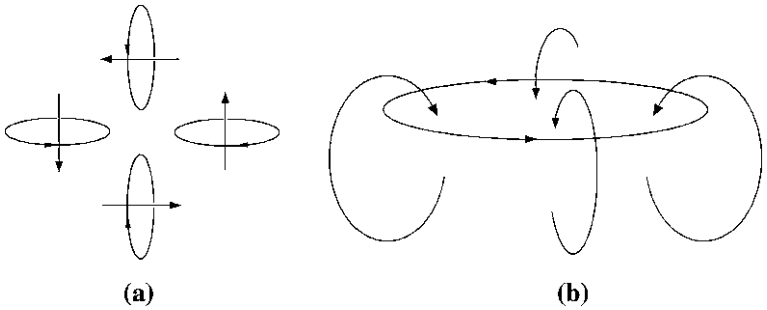

Fig. 4.19 The yoyo structure of a ^{4}He nucleus

poles of the meridian fields also increase accordingly. For example, when a proton attracts a neutron through the opposite poles of their meridian fields (Fig. 4.19c), their same poles repel each other. When the nuclear bond shrinks due to the attraction of the opposite meridian poles, the strength of repulsion between their like meridian poles becomes stronger correspondingly. Both of the attraction and repulsion keep the spinning yoyos apart.

4.3 Laws on State of Motion

Based on the discovery (Wu and Lin 2002, or Chaps. 2 and 3) that spins are the fundamental evolutionary feature and characteristic of materials, in this chapter, we will study the figurative analysis method of the systemic yoyo model and how to apply it to establish laws on state of motion by generalizing Newton's laws of motion. More specifically, after introducing the new figurative analysis method, we will have a chance to generalize all the three laws of motion so that external forces are no longer required for these laws to work. As what's known, these laws are one of the reasons why physics is an "exact" science. And, in the rest of this book, we will show that these generalized forms of the original laws of mechanics will be equally applicable to social sciences and humanity areas as their classic forms in natural science. The presentation in this chapter is based on (Lin 2007).

4.3.1 The First Law on State of Motion

Newton's first law says: An object will continue in its state of motion unless compelled to change by a force impressed upon it. This property of objects, their natural resistance to changes in their state of motion, is called inertia. Based on the theory of blown-ups, one has to address two questions not settled by Newton in his first law:

Question 4.1 If a force truly impresses on the object, the force must be from the outside of the object. Then, where can such a force be from?

Question 4.2 This problem is about the so-called natural resistance of objects to changes in their state of motion. Specifically, how can such a resistance be considered natural?

It is because uneven densities of materials create twisting forces that fields of spinning currents are naturally formed. This end provides an answer and explanation to Question 4.1. Based on the yoyo model (Fig. 4.1), the said external force comes from the spin field of the yoyo structure of another object, which is another level higher than the object of our concern. These forces from this new spin field push the object of concern away from its original spin field into a new spin field. Because if there is not such a forced traveling, the said object will continue its original movement in its original spin field. That is why Newton called its tendency to stay in its course of movement as its resistance to changes in its state of motion and as natural. Based on this discussion and the yoyo model (Fig. 4.1) developed for each and every object and system in the universe, Newton's first law of mechanics can be rewritten in a general term as follows:

The First Law on State of Motion: *Each imaginable and existing entity in the universe is a spinning yoyo of a certain dimension. Located on the outskirt of the yoyo is a spin field. Without being affected by another yoyo structure, each particle in the said entity's yoyo structure continues its movement in its orbital state of motion.*

Because for Newton's first law to hold true, one needs an external force, when people asked Newton where such an initial force could be from, he answered (jokingly?): "It was from God. He waved a bat and provided the very first blow to all things he created (Kline 1972)." If such an initial blow is called the *first push*, then the yoyo model in Fig. 4.1 and the stirring forces naturally existing in each "yoyo" created by uneven densities of materials' structures will be called the second stir.

4.3.2 The Second Law on State of Motion

Newton's second law of motion says that when a force does act on an object, the object's velocity will change and the object will accelerate. More precisely, what is claimed is that its acceleration $\overrightarrow{a}$ will be directly proportional to the magnitude of the total (or net) force $\overrightarrow{F}_{\text{net}}$ and inversely proportional to the object's mass m. In symbols, the second law is written:

$$\overrightarrow{F}_{net} = m\overrightarrow{a} = m\frac{\mathrm{d}\overrightarrow{v}}{\mathrm{d}t} \tag{4.1}$$

Even though Eq. 4.1 has been one of the most important equations in mechanics, when one ponders over this equation long enough, he has to ask the following questions:

Question 4.3 What is a force?

Question 4.4 Where are forces from and how do forces act on other objects?

To answer these questions (the following analysis has appeared in Chap. 2; to make our presentation complete here, we will repeat some relevant parts), let us apply Einstein's concept of "uneven time and space" of materials' evolution (Einstein 1997). So, we can assume

$$\overrightarrow{F} = -\nabla S(t, x, y, z), \tag{4.2}$$

where $S = S(t, x, y, z)$ stands for the time–space distribution of the external acting object (a yoyo structure). Let $\rho = \rho\ (t, x, y, z)$ be the density of the object being acted upon. Then, Eq. 4.1 can be rewritten as follows for a unit mass of the object being acted upon:

$$\frac{\mathrm{d}\overrightarrow{v}}{\mathrm{d}t} = -\frac{1}{\rho(t, x, y, z)}\nabla S(t, x, y, z). \tag{4.3}$$

If $S(t, x, y, z)$ is not a constant, or if the structure of the acting object is not even, Eq. 4.3 can be rewritten as

$$\frac{\mathrm{d}(\nabla x \times \overrightarrow{v})}{\mathrm{d}t} = -\nabla x \times \left[\frac{1}{\rho}\nabla S\right] \neq 0 \tag{4.4}$$

and it represents an eddy motion due to the nonlinearity involved. That is, when the concept of uneven structures is employed, Newton's second law actually indicates that a force, acting on an object, is in fact the attraction or gravitation from the acting object. It is created within the acting object by the unevenness of its internal structure.

By combining this new understanding of Newton's second law with the yoyo model, we get the models on how an object m is acted upon by another object M (see Figs. 4.20 and 4.21).

Figure 4.20a depicts the scenario that the object m is originally situated in a diverging eddy before the converging eddy M pulls it over into the spin field of M. Figure 4.20b describes how the object m in a diverging eddy can be either pushed (direction (a)) or pulled (direction (b)) by M. When m is pulled along the direction (b), it will be captured by the diverging eddy M. In this case, if the spin field M is not powerful enough, the object m will not be pulled to the spin field M out of its original field. Figure 4.20c, d are the models for the scenarios on how the object m is pulled away from its original converging eddy by another eddy of the harmonic spinning pattern. Here, two spinning patterns are said to be harmonic if other than the spinning directions, the spin fields look the same.

To be more specific, the object M, exerting a gravitational pull (Fig. 4.20a, c) or a gravitational push (Fig. 4.20b, d) on an object m, must be much greater than m in order to have an obvious effect on the state of motion of the object m and to capture m. That is, the objects M and m are from different levels and have different

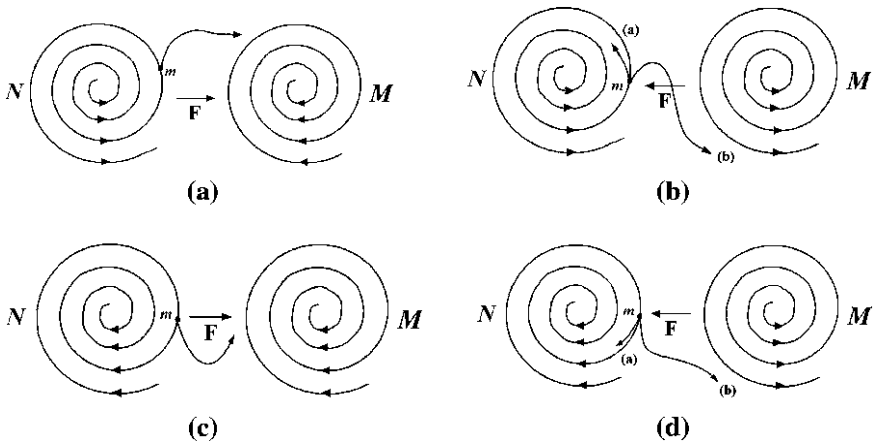

Fig. 4.20 Acting and reacting models with yoyo structures of harmonic spinning patterns **a** Object m is located in a diverging eddy and pulled by a converging eddy M **b** Object m is located in a diverging eddy and pulled or pushed by a diverging eddy M **c** Object m is located in a converging eddy and pulled by a converging eddy M **d** Object m is located in a converging eddy and pulled or pushed by a diverging eddy M

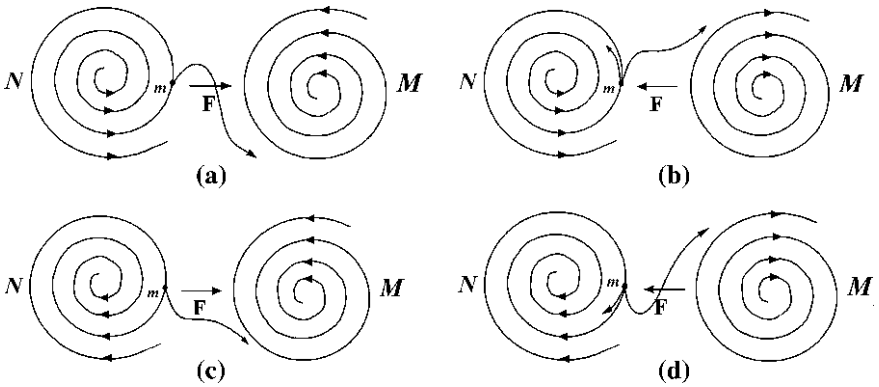

Fig. 4.21 Acting and reacting models with yoyo structures of inharmonic spinning patterns **a** Object m is located in a diverging eddy and pulled by a converging eddy M **b** Object m is located in a diverging eddy and pushed or pulled by a diverging eddy M **c** Object m is located in a converging eddy and pulled by a converging eddy M **d** Object m is located in a converging eddy and pushed or pulled by a diverging eddy M

scales. Otherwise, if they are of the same scale or level, instead of a dot, the object m will be the entire eddy N on the left-hand side in Fig. 4.20a–d. Then, m will not be pulled over to M in Fig. 4.20a. Instead, m will be a supplier of materials for the converging eddy M. In Fig. 4.20b, the objects M and $m = N$ will be pushing each other away. In Fig. 4.20c, the converging eddies $m = N$ and M might attract each other and become one depending on whether or not their spinning directions and

angles agree with each other. And in Fig. 4.20d, M serves as a supplier of the converging eddy $m = N$.

As for objects m and M with their yoyo structures spinning in inharmonic directions (or patterns), the acting and reacting models are given in Fig. 4.21.

Now, by summarizing the discussion above, Newton's Second law can be generalized as follows.

The Second Law on State of Motion: *When a constantly spinning yoyo structure M does affect an object m, which is located in the spin field of another object N, the velocity of the object m will change and the object will accelerate. More specifically, the object m experiences an acceleration* $\overrightarrow{a}$ *toward the center of M such that the magnitude of* $\overrightarrow{a}$ *is given by*

$$a = \frac{v^2}{r} \tag{4.5}$$

where r is the distance between the object m and the center of M and v the speed of any object in the spin field of M about distance r away from the center of M. And, the magnitude of the net pulling force $\overrightarrow{F}_{\text{net}}$ *that M exerts on m is given by*

$$F_{\text{net}} = ma = m\frac{v^2}{r} \tag{4.6}$$

Let us now look at the justification for this generalization. Since it is assumed that the yoyo structure M spins at a constant speed around its center, one can imagine that each point X in the spin field of M travels at a constant speed. However, because the direction of the velocity of X is always changing, the velocity is not constant. So, there must be acceleration for X. Even though this acceleration does not change the speed of X in the spin field of M, it does change the direction of X's velocity to keep it on its roughly circular path.

Let $\overrightarrow{V_1}$ be X's velocity at time $t = t_1$ and $\overrightarrow{V_2}$ X's velocity at time $t = t_2$. Then, $\Delta\overrightarrow{V} = \overrightarrow{V_2} - \overrightarrow{V_1}$ points roughly to the center of M, so does the acceleration, since $\overrightarrow{a} = \frac{\Delta\overrightarrow{V}}{\Delta t}$. The magnitude of this acceleration is given by Eq. 4.5, if the point X is a distance r away from the center of M. Now, by using Newton's second law, Eq. 4.6 is established.

4.3.3 The 3rd and 4th Laws on State of Motion

Newton's third law is commonly known as that to every action, there is an equal, but opposite, reaction. More precisely, if object A exerts a force on object B, then object B exerts a force back on object A, equal in strength but in the opposite direction. These two forces, $\overrightarrow{F}_{A-\text{on}-B}$ and $\overrightarrow{F}_{B-\text{on}-A}$, are called an action/reaction pair.

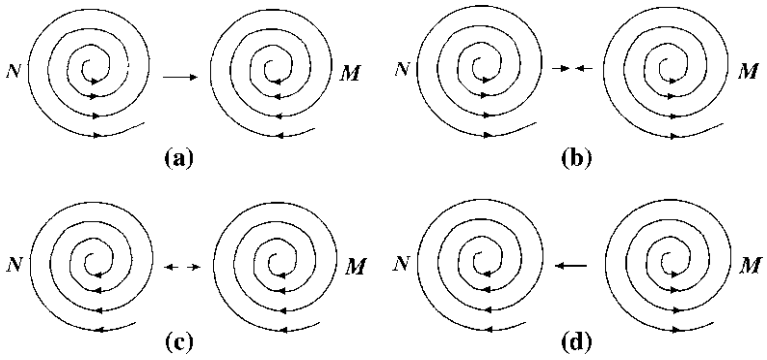

Fig. 4.22 Same scale acting and reacting spinning yoyos of the harmonic pattern **a** *N* diverges and *M* converges **b** Both *N* and *M* diverges **c** Both *N* and *M* converge **d** *N* converges and *M* diverges

Similar to what has been done earlier, let us now analyze the situation in two different angles: two eddy motions act and react to each other's spin field, and two, one spinning yoyo is acted upon by an eddy flow of a higher level and scale. For the first situation, where two eddy motions act and react to each other's spin field, we have the diagrams in Fig. 4.22.

By analyzing each spinning direction, it can be seen that in Fig. 4.22a, the acting and reacting pair is more of *N* exerting a force on *M*, and *N* serves as a supplier of materials, energies, etc., to the converging need of *M*. When both *N* and *M* are relatively stable, object *M* also exerts an opposite but reacting force on *N*. Otherwise, without such a reacting force, *M* would collapse and *N* become diluted. That is the moment both *N* and *M* would have to realign their balances and territories or they both would simply dissolve and disappear.

When both objects *N* and *M* represent yoyo structures as in Fig. 4.22b, they truly exert equal, but opposite, action and reaction forces on each other. Because their spin fields fight against each other, they will push each other further apart. This is one situation Newton's third law is really talking about.

When objects *N* and *M* both converge harmonically as shown in Fig. 4.22c, they exert an attraction or pull on each other. If they are relatively stable, their spin fields achieve a temporary (roughly) balanced acting and reacting forces. However, sooner or later, these two spin fields will try to combine and have a tendency to become one spin field.

As in the situation in Fig. 4.22d, it is the same as that in Fig. 4.22a except that the roles of *N* and *M* are shifted.

For objects *N* and *M* with harmonic spin fields, we have the diagrams in Fig. 4.23.

For the yoyo structures *N* and *M* in Fig. 4.23a, even though the situation is similar to that of Fig. 4.22a where *N* diverges and *M* converges, due to the inharmonic spinning directions, *N* and *M* act and react to each other differently of that of Fig. 4.22a. In our current case, *N* exerts a pushing force on *M* and does not

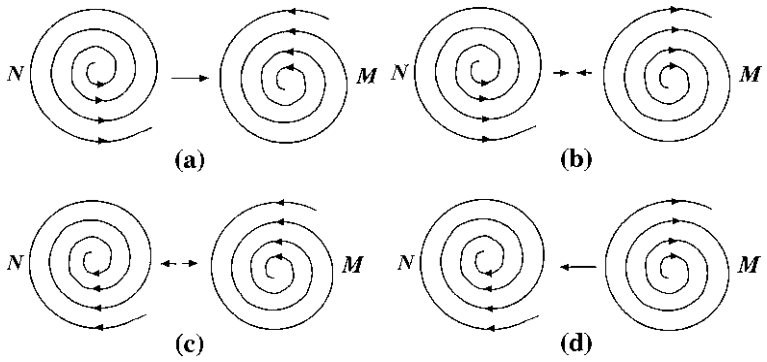

Fig. 4.23 Same scale acting and reacting spinning yoyos of inharmonic patterns **a** *N* diverges and *M* converges **b** Both *N* and *M* diverge **c** Both *N* and *M* converge **d** *N* converges and *M* diverges

easily serve as a supplier of materials, energies, etc., for *M*. When compared to Fig. 4.22b, the yoyo structures *N* and *M* in Fig. 4.23b can work together more peacefully, because their spin fields do not fight against each other, even though they also push each other apart. For the situations in Fig. 4.23c, the spin fields *N* and *M* attract each other. But from their inharmonic spinning directions, it can be seen that they will not combine and will never become one. Situation in Fig. 4.23d is exactly the same as that in Fig. 4.23a with the roles of *N* and *M* switched.

Based on the analysis above, Newton's third law can be generalized for the case of two eddy motions acting and reacting to each other's spin fields as follows:

The Third Law on State of Motion: *When the spin fields of two yoyo structures N and M act and react on each other, their interaction falls in one of the six scenarios as shown in Fig. 4.22a–c and Fig. 4.23a–c. And, the following are true:*

1. *For the cases in (a) of Figs. 4.22–4.23, if both N and M are relatively stable temporarily, then their action and reaction are roughly equal but in opposite directions during the temporary stability. In terms of the whole evolution involved, the divergent spin field (N) exerts more action on the convergent field (M) than M's reaction peacefully in the case of Fig. 4.22a and violently in the case of Fig. 4.23a.*
2. *For the cases (b) in Figs. 4.22–4.23, there are permanent equal, but opposite, actions and reactions with the interaction more violent in the case of Fig. 4.22b than in the case of Fig. 4.23b.*
3. *For the cases in (c) of Figs. 4.22–4.23, there is a permanent mutual attraction. However, for the former case, the violent attraction may pull the two spin fields together and have the tendency to become one spin field. For the later case, the peaceful attraction is balanced off by their opposite spinning directions. And, the spin fields will coexist permanently.*

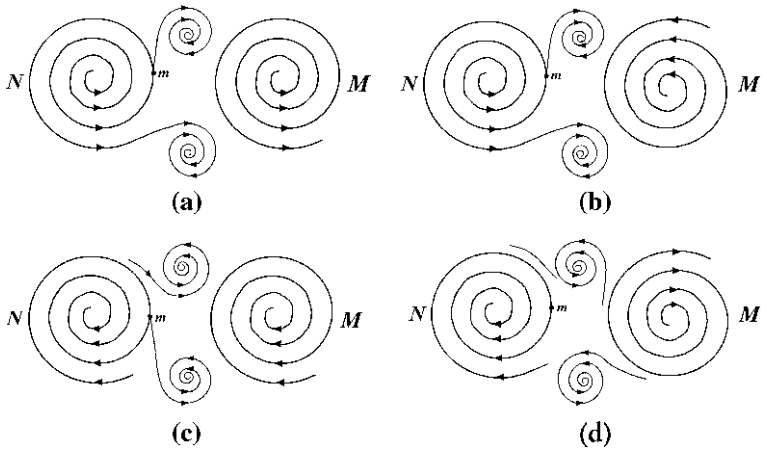

Fig. 4.24 Object *m* might be thrown into a subeddy created by the spin fields of *N* and *M* jointly **a** Object *m* is situated as in Fig. 4.20b **b** Object *m* is situated as in Fig. 4.21a **c** Object *m* is situated as in Fig. 4.20c **d** Object *m* is situated as in Fig. 4.21d

That is to say, Newton's third law holds true temporarily for cases (a), permanently for cases (b) and partially for cases (c) in Figs. 4.22–4.23.

Now, let us look at Newton's third law from the second angle: One spinning yoyo *m* is acted upon by an eddy flow *M* of a higher level and scale. If we assume *m* is a particle in a higher level eddy flow *N* before it is acted upon on by *M*, then we are looking at situations as depicted in Figs. 4.20 and 4.21.

If the spinning yoyo *m* is located in a spin field *N* and affected by the converging spin field *M* (Fig. 4.20a), due to the harmonic spinning directions of *N* and *M*, *m* experiences an action from *M* pulling it away from its current orbit and a reaction from *N* to keep *m* on its current orbit. Because the influence of *M* is external, depending on the structure of the spin field of *m*, *m* might continue its rotation in the spin field *N* with its orbit altered, or it might be on its way to depart from *N*. If *m* does leave the spin field of *N*, it has two possibilities: It might fall into the spin field of *M*, or it might simply be shot out to an area unrelated to either *N* or *M*. When *m* takes the second possibility, it experiences an equal but opposite action from *M* and reaction from *N*.

In terms of the situation in Fig. 4.20b, due to the violent nature facing each other between the spin fields of *N* and *M*, the object *m* will be either kept in the spin field of *N* longer than it would be without the effect of *M*, or it will be captured by the spin field of *M*, or it will fall in a subeddy created by both *N* and *M*, see Fig. 4.24a.

In terms of Fig. 4.20c, due to their conflicting spinning directions at the adjacent area between *N* and *M*, object *m* experiences both a push and a pull from the spin field of *M*. The act of pushing comes from the spinning direction of *M* opposite to that in which *m* travels. The experience of pull is caused by the fact that *M* is a converging eddy motion. In this case, the acts of push

and pull experienced by *m* are neither equal nor opposite of each other, see Fig. 4.24c.

When *m* is located in a converging field *N* and acted upon by a diverging *M*, as shown in Fig. 4.20d, what *m* experiences is (1) more of a push toward the center of *N* without much of any reaction or (2) thrown out of *N* and *M* along the spinning directions of *N* and *M* into their adjacent area.

The situation in Fig. 4.21a is similar to that of Fig. 4.20b. The scenario in Fig. 4.21b is similar to that of Fig. 4.20a except that *m* can only be thrown out by both *N* and *M* along their spinning directions to areas not related to either *N* or *M*. This is when *m* experiences equal but opposite action and reaction from *N* and *M* individually. The experience *m* goes through in Fig. 4.21c is similar to that of Fig. 4.20d except that both *N* and *M* apply a gravitational pull on *m*. Depending on the characteristics of *m*'s own spin field, it may stay in the field of *N*, or travel to the field of *M*, or be thrown out by both *N* and *M* along their common spinning direction in the adjacent area. When *m* is thrown out, *m* experiences an equal, but opposite, action and reaction from *N* and *M*, individually. Now, the situation in Fig. 4.21d is similar to that of Fig. 4.20c except that *M* helps to push *m* to converge to the center of *N* faster. See Fig. 4.24 for more details.

Note: The subeddies created in Fig. 4.24a are both converging, since the spin fields of *N* and *M* are suppliers for them and sources of forces for their spins. Subeddies in Fig. 4.24b are only spinning currents. They serve as middle stop before supplying to the spin field of *M*. Subeddies in Fig. 4.24c are diverging. And, subeddies in Fig. 4.24d are only spinning currents similar to those in Fig. 4.24b.

That is, based on our analysis on the scenario that one object *m*, situated in a spin field *N*, is acted upon by an eddy flow *M* of a higher level and scale, we can generalize Newton's third law to the following form:

The Fourth Law on State of Motion: *When the spin field M acts on an object m, rotating in the spin field N, the object m experiences equal, but opposite, action and reaction, if it is either thrown out of the spin field N and not accepted by that of M (Figs. 4.20a, d and 4.21b, c) or trapped in a sub-eddy motion created jointly by the spin fields of N and M (Figs. 4.20b, c and 4.21a, d). In all other possibilities, the object m does not experience equal and opposite action and reaction from N and M.*

4.3.4 Validity of Figurative Analysis

In the previous three subsections, we have heavily relied on the analysis of shapes and dynamic graphs. To any scientific mind produced out of the current formal education system, he/she will very well question the validity of such a method of reasoning naturally. To address this concern, let us start with the concept of equal quantitative effects. For detailed and thorough study of this concept, please consult with (Chap. 2; Wu and Lin 2002; Lin 1998a).

By equal quantitative effects, it means the eddy effects with non-uniform vortical vectorities existing naturally in systems of equal quantitative movements due to the unevenness of materials. Here, by equal quantitative movements, it means such movements that quasi-equal acting and reacting objects are involved or two or more quasi-equal mutual constraints are concerned with. What is significant about equal quantitative effects is that they can easily throw calculations of equations into computational uncertainty. For example, if two quantities x and y are roughly equal, then $x - y$ becomes a computational uncertainty involving large quantities with infinitesimal increments. This end is closely related to the second crisis in the foundations of mathematics.

Based on recent studies in chaos (Lorenz 1993), it is known that for nonlinear equation systems, which always represent equal quantitative movements (Wu and Lin 2002), minor changes in their initial values lead to dramatic changes in their solutions. Such extreme volatility existing in the solutions can be easily caused by changes of a digit many places after the decimal point. Such a digit place far away from the decimal point in general is no longer practically meaningful. That is, when equal quantitative effects are involved, we face with either the situation where no equation can be reasonably established or the situation that the established equation cannot be solved with valid and meaningful solution.

That is, the concept of equal quantitative effects has computationally declared that equations are not eternal and that there does not exist any equation under equal quantitative effects. That is why OuYang (Lin 1998a) introduced the methodological method of "abstracting numbers (quantities) back into shapes (figurative structures)." Of course, the idea of abstracting numbers back to shapes is mainly about how to describe and make use of the formality of eddy irregularities. These irregularities are very different of all the regularized mathematical quantifications of structures.

Because the currently available variable mathematics is entirely about regularized computational schemes, there must be the problem of disagreement between the variable mathematics and irregularities of objective materials' evolutions and the problem that distinct physical properties are quantified and abstracted into indistinguishable numbers. Such incapability of modern mathematics has been shown time and time again in areas of practical fore castings and predictions. For example, since theoretical studies cannot yield any meaningful and effective method to foretell drastic weather changes, especially about small or zero probability disastrous weather systems, [in fact, the study of chaos theory indicates that weather patterns are chaotic and unpredictable. A little butterfly fluttering its tiny wings in Australia can drastically change the weather patterns in North America (Gleick 1987)], the technique of live report has been widely employed. However, in the area of financial market predictions, it has not been so lucky that the technique of live report can possibly applied as effectively. Due to equal quantitative effects, the movements of prices in the financial market place have been truly chaotic when viewed from the contemporary scientific point of view.

That is, the introduction of the concept of equal quantitative effects has made the epistemology of natural sciences gone from solids to fluids and completed the

unification of natural and social sciences. More specifically, after we have generalized Newton's laws of motion, which have been the foundations on which physics is made into an "exact" science, in the previous three subsections, these new laws can be readily employed to study social systems, such as military conflicts, political struggles, and economic competitions.

Since we have briefly discussed about the concept of equal quantitative effects and inevitable failures of current variable mathematics under the influence of such effects, then how about figurative analysis?

As for the usage of graphs in our daily lives, it goes back as far as our recorded history can go. For example, any written language consists of an array of graphic figures. In terms of figurative analysis, one early work is the book, named *Yi Ching* [or the *Book of Changes*, as known in English (Wilhalm and Baynes 1967)]. For now, no one knows exactly when this book was written and who wrote it. All known is that the book has been around since about three thousand years ago. In that book, the concept of Yin and Yang was first introduced and graphic figures are used to describe supposedly all matters and events in the world. When Leibniz (a founder of calculus) had a hand on that book, he introduced the binary number system and base p number system in modern mathematics (Kline 1972). Later on, Bool furthered this work and laid down the foundation for the modern computer technology to appear.

In our modern days, figures and figurative analysis are readily seen in many aspects of our lives. One good example is the number π. Since we cannot write out this number in the traditional fashion (in either the decimal form or the fraction form), we simply use a Fig. π to indicate it. The same idea is employed to write all irrational numbers. In the area of weather forecasting, figurative analysis is used each and every day in terms of weather maps. In terms of studies of financial markets, a big part of the technical analysis is developed on graphs. So, this part of technical analysis can also be seen as an example of figurative analysis.

From the recognition of equal quantitative effects and the realization of the importance of figurative analysis, OuYang invented and materialized a practical way to "abstract numbers back into shapes" so that the forecasting of many disastrous small or zero probability weather systems becomes possible. For detailed discussion about this end, please consult with Appendix D in (Wu and Lin 2002) and (Lin 1998a,b). To simplify the matter, let us see how to abstract numbers π and $\sqrt{2}$ back into shapes with their inherent structures kept. In Fig. 4.25a, the exact value π is represented using the area of a circle of radius 1. And, the precise value of $\sqrt{2}$ is given in Fig. 4.25b by employing the special right triangle. By applying these simply graphs, the meaning, the precise values and their inherent structures of π and $\sqrt{2}$ are presented once for all.

By providing a rigorous theoretical foundation and empirical justifications for the systemic yoyo model in the previous chapters, also see (Wu and Lin 2002; Lin 2007), observations from many unrelated scientific fields are united under the name of systems. In this chapter, by applying the concept of meridian fields, we have seen how conveniently a novel explanation can be developed for why the

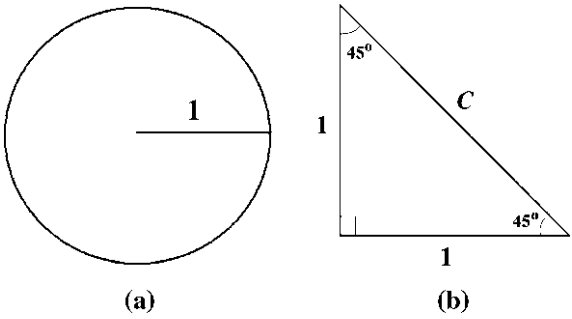

Fig. 4.25 Representing π and $\sqrt{2}$ figuratively and precisely (**a**) The area of the circle is π (**b**) The length of c is $\sqrt{2}$

imaginary line joining the geomagnetic poles of the earth is inclined by approximately 11.3^{o} from the planet's axis of rotation, and unearth the mechanism for mysterious switches of magnetic poles.

Now, with laws on state of motion of materials established, we are ready to investigate social organizations of different scales in the rest of this book.

Part II
Systemic Structure in Civilizations

Chapter 5
The State of a Civilization

In this chapter, we will look at the concept and internal structure of civilizations and reveal the mechanism underlying the many inexplicable phenomena observed in social organizations and human history from the angle of the systemic yoyo model (Wu and Lin 2002; Lin 2007) in order to provide some novel and practically useful explanations. Starting in this chapter and in the rest of this book we will see how systems science in general and the systemic yoyo model in particular can bring forward convincing and tangible results in social science based on sound scientific foundations. Due to the novelty of reasoning and sound conclusions derived from solid scientific foundations, it is expected that this work will produce results that can be truly useful for policy-makers at the national and international levels.

We will see how this systemic model and the relevant properties (Lin 2007) can be readily employed in the study of civilizations by providing a series of novel explanations for some of the basic observational facts that have been employed as granted in sociology (Huntington 1996).

Among the many interesting results, this work includes the following:

1. It is shown mathematically based on two-dimensional eddy currents and the Theorem of Never-Perfect Value Systems that each social entity evolves through stages of expansion and contraction alternately and at each transition the entity goes through a blown-up.
2. Each moment of transition represents a weakest link in the evolution of the entity. If a social entity cannot successfully emerge from a transition, it will cease to exist.
3. A systemic explanation is provided for why civilizations have either multiple centers, or one center, or no center at all.
4. Civilizations situated in lands with unevenly distributed natural resources tend to have higher degrees of unity than others; and the later ones tend to have multiple centers.

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In particular, by considering the natural landscape and distribution of resources of the environment, Bjerknes' circulation theorem is employed to guarantee the formation and functionality of circulations of people, information and knowledge, and commercial goods, and to explain why different civilizations have different underlying assumptions and values of philosophy. Then, Godel's incompleteness theorem is applied to explain how an evolving civilization absorbs elements of other civilizations in order to benefit itself individually without destroying the existing set of values and philosophical assumptions. Based on these discussions, we show how natural environment and geographic conditions in which people live can be employed to separate civilizations from each other. It is shown that political, social, economic, even ideological upheavals are only some of the eddy leaves periodically appearing in the "whirlpools" of civilizations without fundamentally altering the underlying systems of values and philosophical assumptions.

In terms of the internal structure of civilizations, as to what makes some civilizations contain few political units and many other units, the observed phenomenon of eddy leaves of the dishpan experiment and the concepts of centralized and centralizable systems are jointly employed to provide novel explanation. When we look at the problem of how a newly emerging civilization adopts elements of different existing civilizations to build its own organizational structure, the process of forming subeddies is looked at very closely, indicating to the discovery that when a subeddy is naturally created in between existing civilizations, elements of these civilizations useful to the newborn might not be naturally adopted by the subeddy; instead they could also be forced on to the offspring.

This chapter is organized as follows. In Sect. 5.1, we look at the concept of civilizations. Section 5.2 focuses on the internal structure of a civilization. In Sect. 5.3, we study the phenomenon of the specifically Western form of democracy. Section 5.4 shows why blown-ups stand for the weakest links in evolutional transitions. Section 5.5 looks at the existence of nation states within a civilization. Section 5.6 investigates the phenomenon of cultural, economic, and political centers of civilizations.

Some remarks are given in the conclusion statement of this chapter. At this juncture, the reader is advised that most of the historical facts regarding civilizations cited in this book come from Huntington (1996) and the references found there. So, we are deeply in debt to Professor Samuel Huntington for his wonderful book and thorough research. Also, due to the nature of problems considered, we will apply the assumptions of continuity and differentiability as needed in order to take advantage of all the mathematical tools available to us.

5.1 The Concept of Civilizations

Human history is composed of stories of civilizations from ancient Sumerian and Egyptian to Classical and Mesoamerican to Christian and Islamic civilizations and through successive manifestations of Sinic and Hindu civilizations. On different

perspectives, methodology, focus, and concepts, many distinguished historians, sociologists, and anthropologists have well studied the causes, emergence, rise, interactions, achievements, decline, and fall of civilizations (Kissinger 1994).

The concept of civilization was initially developed by the eighteenth century French thinkers; nineteenth century Europeans elaborated the criteria for judging non-European societies as to which were sufficiently civilized to be accepted as members of the European-dominated international system. German thinkers of the nineteenth century distinguished civilizations by mechanics, technology, and material factors, the cultures that involved values and ideals, and the higher intellectual, artistic, moral qualities of a society. Some anthropologists conceived cultures as characteristic of primitive unchanging non-urban societies and complex developed urban and dynamic societies as civilizations. In general, civilization and culture both refer to the overall way of life of a people with a civilization as a large culture writ. They both involve the values, norms, institutions, and modes of thinking to which successive generations in a given society have attached primary importance (Bozeman 1975). By a civilization is meant a space, a cultural area, a collection of cultural characteristics, and phenomena (Braudel 1980, pp. 177, 202), a particular concatenation of worldview, customs, structures, and culture (both material culture and high culture) which forms some kind of historical whole and which coexists with other varieties of this phenomenon (Wallerstein 1991, p. 215), and a kind of moral milieu encompassing a certain number of nations, each national culture being only a particular form of the whole (Durkheim and Mauss 1971, p. 811). For example, blood, language, religion, and way of life were what the ancient Greeks had in common and what distinguished them from the Persians and other nonGreeks. When people are divided by cultural characteristics, they are grouped into civilizations, which are comprehensive, just as the concept of general systems (Lin 1999), none of their constituent units (or elements) can be fully understood in isolation without reference to the encompassing whole (civilization). A civilization is a maximal whole or totality in terms of its fundamental values and philosophical assumptions. Civilizations comprehend without being comprehended by others (Toynbee 1937, p. 455) and

> (they) have a certain degree of integration. Their parts are defined by their relationship with each other and with the whole. If the civilization is composed of states, these states will have more relation with one another than they do with states outside the civilization. They might fight more, and engage more frequently in diplomatic relations. They will be more interdependent economically. There will be pervading aesthetic and philosophical currents (Melko 1969, pp. 8–9).

For example, European states share cultural features that separate them from others such as Chinese or Hindu communities. Chinese, Hindus, and Westerners are not part of any broader cultural entity so they are from different civilizations. Hence, the concept of civilizations stands for the broadest cultural grouping of people and is defined both by common objective elements, such as language, history, religion, customs, institutions, and by the subjective self-identification of people (Huntington 1996, p. 43). Intuitively, the civilization we belong to

represents the biggest "we" within which we feel culturally at home as separated from all "thems" out there. Some civilizations may contain large numbers of people, such as Chinese civilization, and others very small numbers, such as the Anglophone Caribbean. According to the literature, civilizations do not seem to have clear-cut boundaries, precise endings, or beginnings. Throughout history people have redefined their identities and the composition and shape of civilizations have gone through changes over time. Civilizations interact and overlap and are meaningful entities with ambiguous but real dividing lines between them.

Civilizations have life of their own. They tend to be long-lived by appropriately evolving and adapting to the environment. (For example, virtually all major civilizations of the contemporary world have either existed for a millennium, or as with Latin America, are the immediate offspring of another long-lived civilization.) They represent some of the most enduring forms of human associations and possess long historical continuity, representing the longest story of all (Braudel 1980, pp. 209–210). (Bozeman 1992, p. 26) concludes that "international history rightly documents the thesis that political systems are transient expedients on the surface of civilizations, and that the destiny of each linguistically and morally unified community depends ultimately upon the survival of certain primary structuring ideas around which successive generations have coalesced and which thus symbolize the society's continuity."

Now, the following questions naturally arise on the basis of these briefly described understandings of the concept of civilizations.

Question 5.1 How do civilizations or cultures form?

Question 5.2 How do civilizations redefine their identities, composition, and shapes throughout history?

Question 5.3 What factors influence the determination of the ambiguous but real dividing line between civilizations?

Question 5.4 Empires rise and fall, governments come and go. However, civilizations remain and survive political, social, economic, even ideological upheavals. Why?

When comparing people in terms of their values, social relations, customs, and overall outlooks on life, one can readily see significant differences due to their different underlying philosophical assumptions. The evolution of all peoples from across the world is about reinforcing these fundamental philosophical differences, reflecting the varied approaches employed for political and economic development. For example, the recent economic successes and difficulties in achieving stable democracies in Eastern Asian have their sources in relevant cultures. The difficulty of emerging democracy in most of the Muslim world can be explained through the Islamic culture. The paths of development taken by the post communist societies in east Europe and the former Soviet Union were determined by their cultural identities. In terms of the hierarchy of social structures, the Western, Japanese, Chinese, Hindu, Muslim, and African civilizations share little common

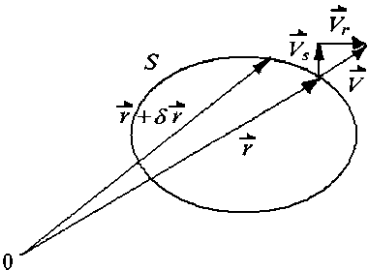

Fig. 5.1 The definition of a closed circulation

ground in terms of religion, social structure, institutions, and prevailing values. National interests are pervasively defined by domestic values, cultures, and institutions and are shaped by international norms and institutions so that states with similar cultures and institutions will see common interest (Huntington 1996). So a natural question arises:

Question 5.5 Why do different civilizations have different underlying assumptions and values of philosophy?

Before addressing these questions let us first look at Bjerknes' Circulation Theorem (1898) (Hess 1959). It shows that nonlinearity mathematically stands (mostly) for singularities, and in terms of physics it represents eddy motions. Such motions are a problem of structural evolutions, a natural consequence of uneven evolutions of materials. In particular, at the end of the ninteenth century, Bjerknes discovered the eddy effects due to changes in the density of the media in the movements of the atmosphere and ocean. By a circulation is meant a closed contour in a fluid. Mathematically, each circulation Γ is defined as the line integral about the contour of the component of the velocity vector locally tangent to the contour. In symbols, if $\vec{V}$ stands for the speed of a moving fluid, S an arbitrary closed curve, $\delta\vec{r}$ the vector difference of two neighboring points of the curve S (Fig. 5.1), then a circulation Γ is defined as follows:

$$\Gamma = \oint_S \vec{V}\delta\vec{r}. \tag{5.1}$$

Through some ingenious manipulations (Wu and Lin 2002), the following well-known Bjerknes' Circulation Theorem is obtained:

$$\frac{\mathrm{d}\vec{V}}{\mathrm{d}t} = \iint_\sigma \nabla\left(\frac{1}{\rho}\right) \times (-\nabla p) \cdot \delta\sigma - 2\,\Omega\frac{\mathrm{d}\sigma}{\mathrm{d}t}, \tag{5.2}$$

where σ is the projection area on the equator plane of the area enclosed by the closed curve S, p the atmospheric pressure, ρ the density of the atmosphere, and Ω the earth's rotational angular speed.

The left-hand side of Eq. 5.1 represents the acceleration of the moving fluid, which according to Newton's second law of mechanics is equivalent to the force

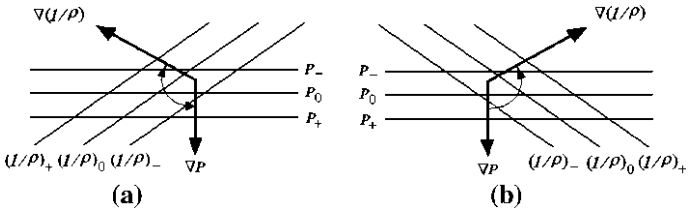

Fig. 5.2 A diagram for solenoid circulations

acting on the fluid. On the right-hand side, the first term is called a solenoid term in meteorology. It is originated from the interaction of the p- and ρ-planes due to uneven density ρ so that a twisting force is created. Consequently, materials' movements must be rotations with the rotating direction determined by the equal p- and ρ-plane distributions (Fig. 5.2). The second term in (5.2) comes from the rotation of the earth.

This theorem reveals the commonly existing and practically significant eddy effects of fluid motions and implies that uneven eddy motions are the most common forms of movements observed in the universe. Because uneven densities create twisting forces, fields of spinning currents are naturally created. Such fields do not have uniformity in terms of types of currents. Clockwise and counter-clockwise eddies always coexist, leading to destructions of the initial smooth, if any, fields of currents. What is important is that the concept of uneven eddy evolutions reveals that forces exist in the structures of evolving objects, and do not exist independently outside the objects.

Now, let us look at the previous questions. At the start of time when still living in primitive conditions, due to the existing natural conditions and available resources within the environment, people formed their elementary beliefs, basic values, and fundamental philosophical assumptions. Since the population density was low, tools available for production, conquering surroundings, etc. were extremely limited and inefficient, minor obstacles of nature in today's standard easily divided people on the same land into small tribes. Since these individual and separated tribes really lived in the same natural environment, they naturally held an identical value system and an identical set of philosophical assumptions, on which they reasoned in order to explain whatever inexplicable, developed approaches to overcome hardships, and established methods to administrate members in their individual tribes. As time went on, better tools for production and transportation and better practices of administration were designed and employed in various individual tribes. The natural desire for better living conditions paved the way for the inventions of new tools, discovery of new methods of reasoning, and the introduction of more efficient ways of administration to pass around the land through word of mouth. So, a circulation of people with special skills started to form. Along with these talented people, information, knowledge, and commercial goods were also parts of the circulation. As a circulation started to appear, Bjerknes's Circulation Theorem guarantees the appearance of abstract

eddy motions over the land consisting of migration of people, spread of knowledge and information, and transportation of goods. This explains how civilizations are initially formed and why different civilizations have different underlying assumptions and values of philosophy.

At this juncture, there is a natural need for us to justify the validity for us to employ the Bjerknes' Circulation Theorem as in the previous paragraph because in theory this theorem holds true only for fluids. First, in Chap. 1, when the systemic yoyo model is introduced, we have given a relevant explanation for how and why each human organization is a spinning pool of fluid, consisting of flows offluids such as energy, information,and materials that circulate within the inside of, go into, and are given off from the organization. Second, at the end of Chap. 2, it is concluded that the universe is a huge ocean of eddies, which changes and evolves constantly. That is, the totality of the physically existing world can be studied as fluids. Third, as described in the previous paragraph, people in the land helped to circulate beliefs, basic values, fundamental philosophical assumptions, knowledge, commercial goods, etc., all of which are studied using continuous or differentiable functions in social sciences in general and economics in particular. When these aspects of a civilization are modeled by such functions, they are generally seen in physics and mathematics as flows of fluids and are widely known as flow functions. Specifically, in the formation of a civilization, it is these commonly shared aspects (or fluids) that make the land to have a living culture, where individual persons are simply local "impurities" of the fluids; and each of the "impurities" carries some concentrated amount of "energy", "information", etc.

As for how civilizations redefine their identities, composition and shapes throughout history, the previous discussion indicates that it was all accomplished through the greater desire of controlling more natural resources that would make one's own yoyo structure more powerful and fighting off different beliefs and value systems that might very well destroy one's own yoyo structure. That is, when each civilization is seen as a spinning yoyo, differences in the natural environments make the abstract but very realistic civilizational yoyos spinning in different ways, such as different spinning speeds, angles, and directions. When two civilizations met either in cooperation or in conflict, in order to sustain themselves viably in the contact, each of them absorbed some elements of the other to benefit themselves individually. To accomplish this without destroying the existing set of values and philosophical assumptions, the receiving civilization had to reformulate the needed elements from the other civilization in its own terms before adding these external elements into their basic system of values and philosophical assumptions. Even though such activities had been carried out throughout the history by various cultures, nations, and civilizations unconsciously, the underlying theoretical guarantee for success is given in the well-known Godel's theorem below:

Theorem 5.1 (Godel's Incompleteness Theorem (Hewitt 2008)) *For any consistent formal, recursively enumerable theory that proves basic arithmetic truths, an arithmetical statement that is true, but not provable in the theory, can be*

constructed. That is, any effectively generated theory capable of expressing elementary arithmetic cannot be both consistent and complete.

Here, the word "theory" refers to an infinite set of statements, some of which are taken as true without proof, which are called axioms, and others (the theorems) are taken as true because they are implied by the axioms. The phrase "provable in the theory" means derivable from the axioms and primitive notions of the theory using standard first-order logic. A theory is consistent if it never proves a contradiction. The phrase "can be constructed" means that some mechanical procedure exists that can construct the statement, given the axioms, primitive notions, and first-order logic. The elementary arithmetic consists merely of additions and multiplication over the natural numbers. The resulting true but not provable statement is often referred to as the Godel sentence for the theory, although there are infinitely many other statements in the theory that share with the Godel sentence the property of being true but not provable from the theory.

Our yoyo model analysis and discussion lead naturally to explanations on how civilizations are separated from each other and how civilizations remain and survive political, social, economic, even ideological upheavals, although empires rise and fall, and governments come and go. In particular, a good indicator for telling different civilizations apart from each other is the natural environment and geographic conditions in which people live. For example, let us think of some islanders who are cut off from other varieties of environmental conditions by large bodies of water. If throughout history their closest neighboring lands are always occupied by well-formulated civilizations (vigorously spinning yoyos), then the islanders (constituting a small and barely spinning yoyo) have no alternative other than forming their own civilization while periodically absorbing useful and beneficial elements from the neighboring civilizations. And when the neighboring civilizations (as seen as spinning fluids in the dishpan experiment) experience internal chaos (that is when the spinning fluids contain traveling eddy leaves), the small civilizational yoyo of the islanders might have the opportunity to expand temporarily onto the land occupied by the organizationally chaotic people.

As for political, social, economic,and even ideological upheavals, they only appear on the surface of civilizations without fundamentally altering the underlying systems of values and philosophical assumptions. They represent some of the eddy leaves periodically appearing in the "whirlpools" of civilizations. So, they are natural phases of the evolution of civilizations. As for the rise and fall of empires, it is like the situation of an ocean of spinning yoyos, the appearance of which is similar to what is shown on the charts of airstreams of the earth as seen from above the North Pole, where one spinning pool, helped by some invisible joint forces from other whirlpools, attempts to conquer many other pools of various sizes by forcing each of them to "spin" in exactly the same way as itself. When the forces that combine internal and external strengths become exhausted, the most likely consequence is that the conquering whirlpool structure is greatly weakened, while the other pools either recover back to their original spinning motion or spins more energetically than before because their basic sets of values

and philosophical assumptions have been just renewed and/or expanded by adopting some of the useful elements from the failed conquering whirlpool. Similar to the situation of political, social, economic, and ideological upheavals, governments are just temporary centers of cultural yoyo structures. As cultures evolve, their centers also move from one "location" to another, similar to the case of the magnetic poles of the earthly yoyo structure.

5.2 Internal Structure of a Chosen Civilization

Civilizations move through seven stages: mixture, gestation, expansion, age of conflict, universal empire, decay, and invasion (Quigley 1961, 146ff); each civilization arises as a response to challenges and then goes through a period of growth involving increasing control over its environment produced by a creative minority, followed by a time of troubles, the rise of a universal state, and then disintegration (Toynbee 1934–1961, 569ff). For example, the Western civilization began to take shape between A.D. 370 and 750 through the mixing of elements of Classical, Semitic, Saracen, and Barbarian cultures. Its period of gestation lasting from the middle of the eighth century to the end of the tenth century was followed by movement back and forth between phases of expansion and phases of conflict. The West now appears to be moving out of its phase of conflict, Western civilization has become a security zone and intra-West wars are virtually unthinkable. The West is developing its equivalent of a universal empire in the form of a complex system of confederations, federations, regimes, and other types of cooperative institutions that embody at the civilizational level its commitment to democratic and pluralistic policies. The West has become a mature society entering into what future generations will look back to as a golden age a period of peace, resulting from the absence of any competing units within the area of the civilization itself, and from the remoteness or even absence of struggles with other societies outside. It is also a period of prosperity that arises from the ending of internal belligerent destruction, internal trade, the establishment of a common system of weights, measures, and coinage, and from the extensive system of government spending associated with the establishment of a universal empire. In other past civilizations, this phase of blissful golden age with its visions of immortality has ended either dramatically and quickly with the victory of an external society, or slowly and equally painfully by internal disintegration.

Civilizations grow because they have an instrument of expansion, such as a powerful military, or a religious, political, or economic organization that accumulates surplus and invests it in constructive productions. Civilizations decline when they stop the application of surplus to new ways of doing things. In modern times, we see that the rate of investment decreases, this happens because the social groups controlling the surplus have a vested interest in using it for non-productive but ego-satisfying purpose,which distribute the surpluses to consumption but do not provide more effective methods of production. People live off their capital and

the civilization moves from the stage of the universal state to the stage of decay. This is a period of acute economic depression, declining standards of living, civil wars between the various vested interests, and growing illiteracy; the society grows weaker and weaker. Vain efforts are made to stop the wastage of legislation, but the decline continues, the religious, intellectual, social, and political levels of the society began to lose the allegiance of the masses of the people on a large scale. New religious movements begin to sweep over the society; there is growing reluctance to fight for the society or even to support it by paying taxes. Decay then leads to the stage of invasion when the civilization, no longer able to defend itself because it is no longer willing to defend itself, lies wide open to 'barbarian invaders,' who often come from another younger, more powerful civilization (Quigley 1961).

Since the mid 1990s, the West has had many characteristics as Quigley identified as those of a mature civilization on the brink of decay. For example, economically, the West is far richer than any other individual civilization, however, with low-economic growth rates, savings rates, and investment rates; individually and collectively, consumption has priority over the creation of capabilities for future economic and military power; and demographically, natural population growth was low. And, far more significant than the economic and demographic problems are those of moral declining, cultural suicide, and potential disunity of the West. Some of the manifestations of moral decline include: (1) increases in anti-social behavior; (2) family decay; (3) a decline in social capital, that is, membership in voluntary associations and the interpersonal trust associated with such memberships; (4) general weakening of work ethic and the rise of a cult of personal indulgence; and (5) decreasing commitment to learning and intellectual activity.

The political composition of civilizations varies from one civilization to another and varies over time within a civilization. A civilization may contain a few or many political units. These units may be city states, empires, federations, confederations, nation states, or multi-national states, all of which may have varying forms of government. As a civilization evolves over time, changes normally occur in the number and nature of its constituent political units (Huntington 1996, p. 44). China is a civilization that pretends to be a state; Japan is a civilization that is a state. In modern world, most civilizations contain two or more states or political entities (Pye 1990). There are at least twelve major civilizations throughout history, seven of which no longer exist (Mesopotamian, Egyptian, Cretan, Classical, Byzantine, Middle American, and Andean) and five which do (Chinese, Japanese, Indian, Islamic, and Western). To these five civilizations, it is useful in the contemporary world to add orthodox Latin American, and African civilizations (Melko 1969, p. 133; Huntington 1996, p. 45).

Question 5.6 What makes some civilizations contain few political units and other many units?

To answer this question, we need to place civilizations in the historical flow of time and see each civilization as a spinning yoyo coexisting with many other

civilizational yoyos. By doing so, our earlier systemic yoyo analysis indicates that as long as a civilization has uneven internal organization, there must be uneven moments of forces. Combining with the naturally existing uneven gradient forces produced by the uneven internal organization, the abstract but realistic yoyo structure of the civilization will have to spin. That is, the uneven internal organization of an entity produces eddy motion for the entity. And, the more uneven internal organization the entity possesses, the greater the naturally existing uneven gradient forces will be, and the faster the entity will spin. In a fast spinning civilization, where the high speed of rotation represents a high degree of unity of the underlying civilization, the number of political units changes over time just as what is shown in the dishpan experiment. This analysis also indicates that it is also possible for a civilization to have many political units as long as the overall internal organization of the civilization is relatively even. This end combined with what is obtained earlier leads to the following conclusions:

1. Civilizations that are situated in such lands that have severely, unevenly distributed natural resources tend to have higher degrees of unity than those that occupy lands with relatively even distribution of necessities for the existence of ordinary lives;
2. Civilizations existing on rich lands with relatively even distributions of natural resources tend to have multiple centers (known as core states).

Also, the phenomenon of political units in a civilization can be modeled by using the concept of centralized and centralizable systems. In particular, (Hall and Fagen 1956) introduced the concept of centralized systems, where a system is centralized if one object or a subsystem of the system plays a dominant role in the system's operation. The leading part can be thought of as the center of the system, since a small change in it would affect the entire system, causing considerable changes across the entire spectrum. (Lin 1989) applied the concept of centralized systems to the study of some phenomena in sociology, obtaining several interesting results, including an argument on why there must be a few people in each community who dominate over others. In particular, a system (Lin 1987) is an ordered pair of sets, $S = (M, R)$, such that M is the set of all objects and R a set of some relations defined on M. The sets M and R are called the object and relation set of S, respectively. Here, each $r \in R$ is defined as follows: there is an ordinal number $n = n(r)$, a function of r, called the length of the relation r, such that $r \subseteq M^n$, where

$$M_n = \underbrace{M \times M \times \cdots \times M}_{n \text{ times}} = \{f : n \to M \text{ is a mapping}\}$$

is the Cartesian product of n copies of M. A system $S = (M, R)$ is trivial, if $M = R = \varnothing$. Given two systems $S_i = (M_i, R_i)$, $i = 1, 2$, S_1 is a partial system of S_2 if either (1) $M_1 = M_2$ and $R_1 \subseteq R_2$ or (2) $M_1 \subset M_2$ and there exists a subset $R' \subseteq R_2$ such that $R_1 = R'|M_1 = \{f: f$ is a relation on M_1 and there is $g \in R'$ such that f is the restriction of g on $M_1\}$. In symbols,

$$R'|M_1 = \left\{f : g \in R'(f = g|M_1)\right\},$$

where $g|M_1 \equiv g \cap M_1^{n(g)}$. A system $S = (M, R)$ is called a centralized system, if each object in S is a system and there is a non-trivial system $C = (M_C, R_C)$ such that for any distinct elements x and $y \in M$, say, $x = (M_x, R_x)$ and $y = (M_y, R_y)$, then $M_C = M_x \cap M_y$ and $R_C \subseteq R_x|M_C \cap R_y|M_C$. The system C is called a center of S. The following has been shown:

Theorem 5.2 (Lin 1988b). *Assume ZFC. Suppose that $S = (M, R)$ is a system such that $|M|$, the cardinality of M, $\geq c$, where c is the cardinality of the set of all real numbers, and that each object in S is a system with finite object set. If there exists such an element that belongs to at least c objects in M, there then exists a partial system B of S with an object set of cardinality $\geq c$ and B forms a centralized system.*

One interpretation of this result is that as long as a civilization forms a system, as defined here, where different parts of the civilization are closely connected by various relationships, and some special elements exist such that each of these elements transcends through a great number of the parts of the civilization, then in this civilization, at least one center (or political unit) will appear. And, when dictated by nature, such as severely uneven distribution of resources, various existing centers (political units) will naturally fight for control of greater power and influence. In the process of power struggle, this theorem indicates that many political units along with their spin fields could be eliminated without damaging the underlying structure of the civilization. This theoretical result might be the explanation for the phenomenon of Sinic single center of political power and the historical fact that after each unification of China, all oppositions were mercilessly eliminated, which, according to our yoyo model analysis, created a uniform motion in the civilizational spin field.

Let $S_i = (M_i, R_i)$, $i = 1, 2$ be two systems and h: $M_1 \to M_2$ a mapping. Define two classes $\hat{M}_i, i = 1, 2$, and a class mapping $\hat{h} : \hat{M}_1 \to \hat{M}_2$ by using the transfinite induction as follows:

$$\hat{M}_i = \bigcup\nolimits_{n \in \mathrm{Ord}} M_i^n, \quad i = 1, 2,$$

and for each $x = (x_0, x_1, \ldots, x_\alpha, \ldots) \in \hat{M}_1$,

$$\hat{h}(x) = (h(x_0), h(x_1), \ldots, h(x_\alpha), \ldots) \in \hat{M}_2,$$

where Ord is the class of all ordinals. For each relation $r \in R_1, \hat{h}(r) = \{h(x) : x \in r\}$ is a relation on M_2 with length $n(r)$. Without confusion, h will be used to indicate the class mapping $\hat{h}$ and is seen as a mapping from the system S_1 into the system S_2, denoted $h : S_1 \to S_2$. When h: $M_1 \to M_2$ is surjective, injective, or bijective, the mapping h: $S_1 \to S_2$ is also seen as surjective, injective, or bijective, respectively.

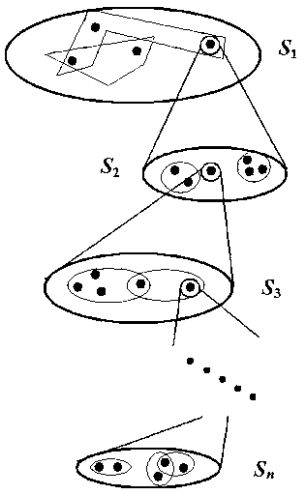

Fig. 5.3 A graphical representation of an n-level system

The systems S_i, $i = 1, 2$, are similar if there is a bijection h: $S_1 \to S_2$ such that $h(R_1) = \{h(r) : r \in R_1\} = R_2$. The mapping h is called a similarity mapping from S_1 onto S_2. A mapping h: $S_1 \to S_2$ is termed to as a homomorphism from S_1 into S_2 if $h(R_1) \subseteq R_2$.

A system $S = (M, R)$ has n levels (Lin 1989), where n is a fixed whole number, if (1) each object $S_1 = (M_1, R_1)$ in M is a system, called the first-level object system of S; (2) if $S_{n-1} = (M_{n-1}, R_{n-1})$ is an $(n-1)$th-level object system of S, then each object $S_n = (M_n, R_n) \in M_{n-1}$ is a system, called the nth-level object system of S. For a graphic representation of this concept, see Fig. 5.3.

A system S_0 is n-level homomorphic to a system A, where n is a fixed natural number, if there exists a mapping h_{S0}: $S_0 \to A$, called an n-level homomorphism, satisfying the following:

1. The systems S_0 and A have no non-system kth-level objects, for each $k < n$.
2. For each object S_1 in S_0, there exists a homomorphism h_{S1} from the object system S_1 into the object system $h_{S0}(S_1)$.
3. For each $i < n$ and each ith-level object S_i of S_0, there exist level object systems S_k, for $k = 0, 1, \ldots, i-1$, and homomorphisms h_{Sk}, $k = 1, 2, \ldots, i$, such that S_k is an object of the object system S_{k-1} and h_{Sk} is a homomorphism from S_k into $h_{S_{k-1}}(S_k)$, for $k = 1, 2, \ldots, i$.

A system S is centralizable (Lin 1999), if it is 1-level homomorphic to a centralized system S_C under a homomorphism h: $S \to S_C$ such that for each object m in S the object systems m and $h(m)$ are similar. Each center of S_C is also called a center of S.

Theorem 5.3 (Lin 1999) *A system $S = (M, R)$ with two levels is centralizable, if and only if there exists a nontrivial system $C = (M_C, R_C)$ such that C is embeddable in each object S_1 of S; that is, C is similar to a partial system of S_1.*

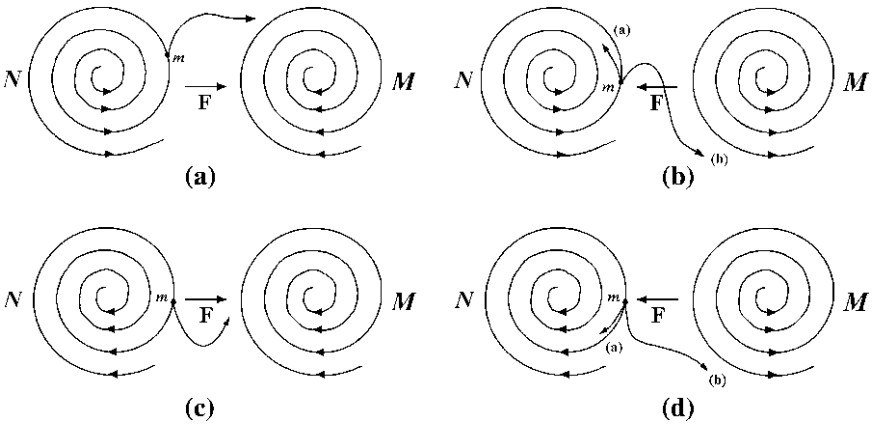

Fig. 5.4 Acting and reacting models with yoyo structures of harmonic spinning patterns. **a** Object *m* is located in a diverging eddy and pulled by a converging eddy *M*. **b** Object *m* is located in a diverging eddy and pulled or pushed by a diverging eddy *M*. **c** Object *m* is located in a converging eddy and pulled by a converging eddy *M*. **d** Object *m* is located in a converging eddy and pulled or pushed by a diverging eddy *M*

This result provides the theoretical foundation for checking whether or not a civilization that is currently in a chaotic state would soon become organized. When this theorem is mapped over to the current state of affairs of the Islamic world, one should be able to see where the Islamic civilization is at in their potential civilizational revival for the ultimate appearance of their powerful civilizational spin field. For our purpose here, all the details are omitted.

Americans consumed millions of Japanese cars, cameras, television sets, and electronic gadgets during the 1970s and 1980s, which created considerable antagonism toward Japan, and lived off Chinese goods starting in late 1980s, which similarly led to resentment toward the Chinese. In 1993, 88t of the 100 films most attended throughout the world were American, and two American and two European companies dominated the collection and dissemination of news on a global basis (Havel 1995), which also seemed to have produced alienation from across the world against America. So, considering the emerging West in the eleventh and thirteenth centuries, we have to ask:

Question 5.7 How does a new emerging civilization adopt elements of different existing civilizations to build its own organizational structure?

For a new emerging civilization to adopt elements of different existing civilizations, the new civilization has to be created with the objects *m* out of scenarios of Figs. 5.4b, c and 5.5a, d. For scenarios in Figs. 5.4a, d and 5.5b, c no viable subeddies can be fruitfully produced. If a subeddy is indeed created in cracks between existing spinning fields, elements of these civilizations useful to the newborn might not be naturally adopted by the subeddy. They could also be forced on to the offspring. For example, Japan's forcible opening to the West by

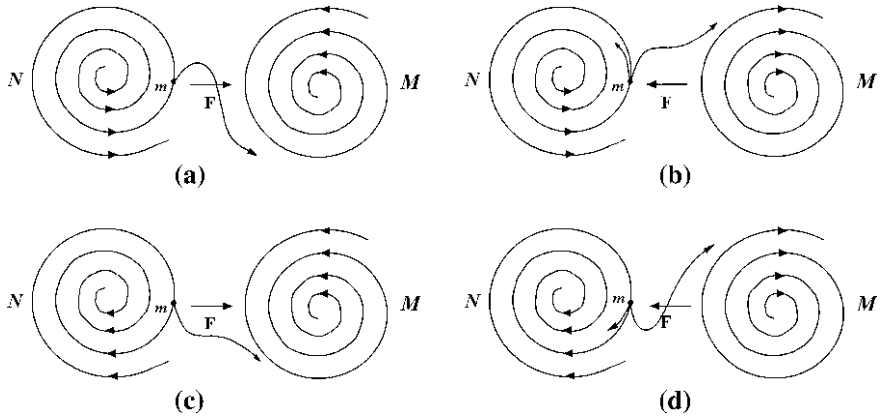

Fig. 5.5 Acting and reacting models with yoyo structures of inharmonic spinning patterns. **a** Object *m* is located in a diverging eddy and pulled by a converging eddy *M*. **b** Object *m* is located in a diverging eddy and pushed or pulled by a diverging eddy *M*. **c** Object *m* is located in a converging eddy and pulled by a converging eddy *M*. **d** Object *m* is located in a converging eddy and pushed or pulled by a diverging eddy *M*

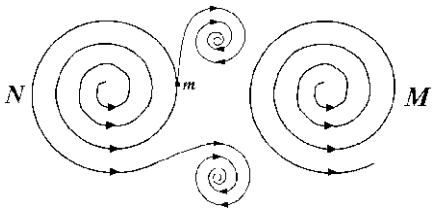

Fig. 5.6 Object *m* might be thrown into a sub-eddy created by the spin fields of *N* and *M* jointly. Object *m* is situated as in Fig. 5.4b

Commodore Perry in 1854 vividly shows that after tasting the greatness of the Western civilization by external force or pressure, Japan voluntarily made its dramatic decision to learn from the West following the Meiji Restoration in 1868. Other than the potential scenario for a new civilization to be born as shown in Fig. 5.6, other possibilities are given in Fig. 5.7.

5.3 The Western Democracy

When comparing people in terms of their values, social relations, customs, and overall outlooks on life, one can readily see significant differences due to their different underlying philosophical assumptions. And the evolution of all people from across the world is about reinforcing these fundamental philosophical differences, reflecting the varied approaches employed for political and economic development. For example, recent economic successes and difficulties in achieving stable democracies in Eastern Asian have their sources in relevant cultures. The difficulty of emerging democracy in most of the Muslim world can be

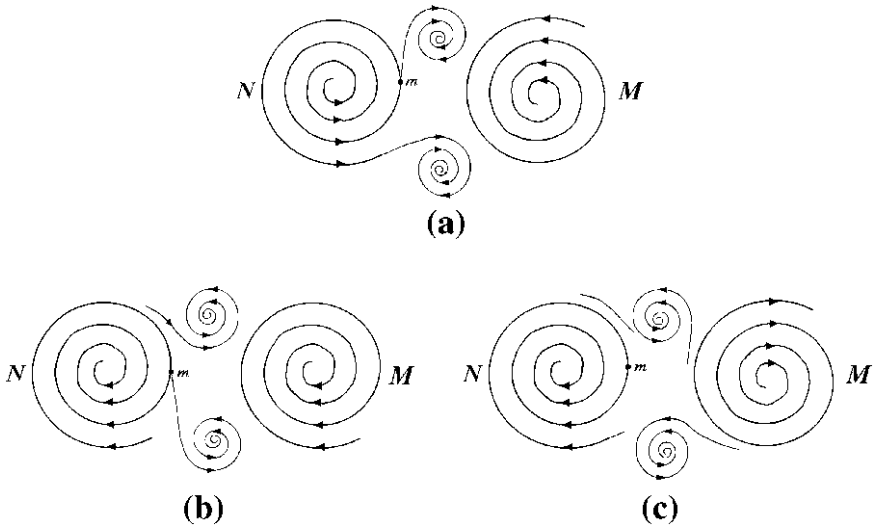

Fig. 5.7 Additional ways for new civilizations to be created by the spin fields of N and M jointly. **a** Object m is situated as in Fig. 5.5a. **b** Object m is situated as in Fig. 5.4c. **c** Object m is situated as in Fig. 5.5d

explained through the Islamic culture. The paths of development taken by the post-communist societies in east Europe and the former Soviet Union were determined by their cultural identities. In terms of the hierarchy of social structures, the Western, Japanese, Chinese, Hindu, Muslim, and African civilizations share little common ground in terms of religion, social structure, institutions, and prevailing values. National interests are pervasively defined by domestic values, cultures, and institutions and shaped by international norms and institutions so that states with similar cultures and institutions will see common interest (Huntington 1996). So the following natural question arises:

Question 5.8 Why was Western democracy not originated from Eastern Asian or other parts of the world?

To address this question, let us treat each culture and every social organization as an abstract, high dimensional spinning yoyo. The geographic location of Europe, where the land is mainly surrounded by oceans and has rivers well distributed throughout the land, indicates that the Europeans should be naturally accustomed to open thinking and freedom of movements (or individualism) without much need for difficult negotiation and compromise with anyone. In comparison, for example, China is enclosed by deserts or extreme natural conditions in the north, cold, mountainous, and dry yellow-earth plateau in the west, the Himalayas in the southwest, lush jungles in the south, and open seas in the east. And throughout much of the land, people depend on one of the two river systems, the Yellow River and the Yangtze River, to survive. So, the geographic

environment and condition of China more resembles that of the spinning dish in Fultz's dishpan experiment with only the east open to large bodies of water. However, in ancient times without much capability to travel overseas, China was completely situated in a "dish with a solid periphery." So, if we imagine the Chinese civilization as a realization of a high dimensional spinning yoyo (of fluids), then Chinese history is pretty much a social version of the periodic pattern changes observed in the dishpan experiment, where as a nation, it has gone through divisions and unifications alternately. In terms of social organizations, seen as spinning pools of fluids, each nation or culture goes through stages of expansion and contraction alternately and at each transition from expansion to contraction or from contraction to expansion, the social entity goes through a blown-up, which represents a weakest link in the evolution of the social entity. If a social entity cannot successfully transform from a stage of expansion or contraction to that of contraction or expansion that entity as an abstract spinning yoyo will no longer exist as a viable entity or identifiable system. This explains why some civilizations in the past, such as Mesopotamian, Egyptian, Cretan, Classical, Byzantine, Middle American, Andean, disappear. To support this theory, let us now look at how we can prove mathematically that each two-dimensional eddy current can constitute an alternating transformation between converging and diverging flows.

By introducing a flow function, the equations for two-dimensional fluid dynamics can be written as follows (As it has been argued in different occasions so far in this book, modeling and investigating social organizations as pools of fluids are a valid and legitimate approach. For more details, see the related paragraphs about the systemic yoyo model in Fig. 1.1, the conclusions of Chap. 2, and the explanation of Problem 5.5):

$$\begin{cases} (\Delta\psi)_t = J(\Delta\psi, \psi) \\ \Delta\psi(x,t)|_{t=0} = \Delta\psi_0 \end{cases}. \tag{5.3}$$

If in Eq. 5.3_1, we add $J(f,\psi), f = 2\Omega\sin\varphi$, where φ stands for the earthly latitude, then we obtain the general equation of eddy motion for a spinning fluid, such as the atmosphere, where $J(A,B) = \frac{\partial A}{\partial x}\frac{\partial B}{\partial y} - \frac{\partial A}{\partial y}\frac{\partial B}{\partial x}$ is the Jacobi operator. No doubt, $\psi(x,y,t)$ is a two dimensional flow function, $u = -\frac{\partial\psi}{\partial y}, v = \frac{\partial\psi}{\partial x}$; $\Delta\psi = \nabla^2\psi = \varsigma$ the vorticity in the vertical direction. Equation 5.3 represents the Cauchy initial value problem of a two-dimensional spinning fluid. It in form is equivalent to the two-dimensional equation of fluid mechanics in Euler language. Since this equation comes from the fluid mechanics of continuous media, we have to introduce the assumption that $\psi_0(x,y)$ is continuously differentiable on $-\infty < x, y < +\infty$ and

$$|\psi_0(x,y)| \le k,\ k = \text{const.} \tag{5.4}$$

Now, assume that $\psi(x,y,t)$, for $t \in [0,T]\ (T < \infty)$; $x, y \in (0,L)$ is uniformly continuous. And for the convenience of discussion, let us take

$$\begin{cases} x, y = 0, & \Delta\psi(x, 0, t) = \Delta\psi(x, 0, t) = 1 \\ x, y = L, & \Delta\psi(L, y, t) = \Delta\psi(x, L, t) = \Delta\psi_L \end{cases} \tag{5.5}$$

and, without loss of generality, let us introduce the separate variables as follows:

$$\begin{aligned} \psi\,(x, y, t) &= A(t)\Psi(x, y), \\ \psi_0(x, y, 0) &= A(0)\Psi(x, y), \end{aligned} \tag{5.6}$$

where assume that $A(t)$ is positive for $t \in [0, T]\,(T > 0)$. Substituting Eq. 5.6 into Eq. 5.3 and applying some simplification produce

$$\Delta\Psi \frac{\mathrm{d}A}{\mathrm{d}t} = A^2 \left[\Psi_y (\Delta\Psi)_x - \Psi_x (\Delta\Psi)_y \right]. \tag{5.7}$$

Evidently, the two terms within [ ] in Eq. 5.7 are essentially the same. So, let us take the first term for our discussion. Taking $\frac{\mathrm{d}A}{\mathrm{d}t} = \dot{A}$ produces

$$\Delta\Psi \dot{A} = A^2 \Psi_y (\Delta\Psi)_x. \tag{5.8}$$

By using condition Eq. 5.4 and factoring the not expanded variables, let us take

$$\begin{aligned} &\frac{\dot{A}}{A^2} = -\lambda, \\ &(\Delta\psi)_x + \frac{\lambda}{\Psi_y} \Delta\Psi = 0 \end{aligned} \tag{5.9}$$

From Eqs. 5.9 and 5.6, it follows that

$$A = \frac{A_0}{1 + \lambda A_0 t}. \tag{5.10}$$

When $1 + \lambda A_0 t = 0$ or $t = t_b$, we have

$$\lambda = -\frac{1}{A_0 t_b} \text{ or } t_b = -\frac{1}{\lambda A_0}. \tag{5.11}$$

Substituting this expression into Eq. 5.10 and then point-multiplying the result by $\Delta\Psi$ produce

$$\Delta\psi = A(t)\Delta\Psi(x, y) = \frac{A_0 \Delta\Psi}{1 + \lambda A_0 t} = \frac{\Delta\psi_0}{1 - t/t_b} = \frac{\zeta_0}{1 - t/t_b}, \tag{5.12}$$

where ζ_0 represents the initial vorticity. So, Eq. 5.12 uncovers a transformation of the eddy current. When $t \geq t_b$, a blown-up of transitional changes occur. What deserves our attention is that this change is reversible.

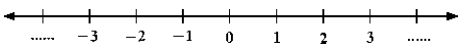

Fig. 5.8 Evolution of the head's benevolence and selfish members' behaviors

If the initial vorticity satisfies $\zeta_0 > 0$, then when $t < t_b$, the movement will be a continuation of the positive vorticity. When $t = t_b$, the movement experiences a blown-up. When $t > t_b$, since $(1 - t/t_b) < 0$, the movement changes from the initial$\zeta_0 > 0$ to the vorticity of $\zeta_0 < 0$. If the initial value is a negative vorticity $\zeta_0 < 0$, then the changes will be opposite of what is described above. So, for two-dimensional eddy currents, positive and negative rotations can be transformed into each other.

5.4 Blown-Ups: Weakest Links in Evolutional Transitions

In this section, let us apply the following result of microeconomics to support the claim that each moment of transition or blown-up that it bridges a transition between organizational expansion and contraction represents a weakest link in the evolution of a social entity.

Theorem 5.4 (The Theorem of Never-Perfect Value Systems (Lin and Forrest 2008b)) *In a family of at least two members, one member h is the head who is benevolent and altruistic toward all other members. The head establishes a value system for all members of the family to follow so that in his eyes, every selfish member will be better off both for now and for the future. If a selfish member k measures up well to the value system, he will then be positively rewarded by the head h. Unfortunately, the more effort member k puts into measure up to the value system, the more he will be punished by the reward system.*

As depicted in Fig. 5.8 and as in practical situations, what is described in this theorem is that the benevolent head transfers his resources to other family members in a periodic fashion over time without an end in sight, where although the word of "benevolent" is used, based on the proof of this theorem it only means that he is a person responsible to distribute wealth around, also the phrase of "his resources" does not necessarily mean that he is the person who has made all the wealth. The idea of value systems implies that the head tells other members at some time moment along the time line that starting at a certain pay period, each member's behavior will affect the amount he will receive from the head at the end of that period. And, the head will design his response to each member's behaviors in such a way as to maximize his own utility. That is, Theorem 5.4 explains a sequential behavioral change and reflection over time between the head and his family members. In Fig. 5.8, the scale marks on the time line represent the moments of individual asset distributions and are given for reference purposes without much practical implications. Mark 0 can be located anywhere on the line as the beginning

of our discussion or focus. Negative scale marks represent the moments of distribution of the past and the positive marks the future moments of distribution.

Example 5.1 To see how the result in Theorem 5.4 materially acts out, let us assume that a family consists of two members: the benevolent and altruistic head h and a selfish member k, and Y_k the index outlined in the proof of Theorem 5.4. Let member k's utility function be given as follows:

$$U_k = U_k(X_k, Y_k) = X_k(1 - Y_k), \tag{5.13}$$

where X_k is member k's total goods consumption and $(1-Y_k)$ stands for his degree of laziness, and the head's utility function be

$$U_h = U_h(X_h, U_k) = X_h + \sqrt{U_k} = X_h + \sqrt{X_k(1 - Y_k)}. \tag{5.14}$$

Assume that the reward from the head h to member k is determined by

$$h_k = wY_k, \tag{5.15}$$

where w is a fixed constant > 0. Then the total consumption of k is

$$X_k = I_k + h_k = I_k + wY_k,$$

where I_k is member k's own income unrelated to Y_k.

To the family head, he needs to maximize his utility function subject to the budgetary constraint:

$$X_h + X_k = X_h + (I_k + h_k) = I_h + I_k. \tag{5.16}$$

The first-order condition for this optimization problem is given by

$$\begin{bmatrix} \dfrac{\partial U_h}{\partial X_h} \\ \dfrac{\partial U_h}{\partial X_k} \\ \dfrac{\partial U_h}{\partial Y_k} \end{bmatrix} = \begin{bmatrix} 1 \\ \dfrac{1 - Y_k}{2\sqrt{X_k(1 - Y_k)}} \\ \dfrac{w(1 - Y_k) - X_k}{2\sqrt{X_k(1 - Y_k)}} \end{bmatrix} = \lambda \begin{bmatrix} 1 \\ 1 \\ -w \end{bmatrix}, \tag{5.17}$$

where $\lambda = 1$ the Lagrange multiplier. So, from Eq. 5.17, it follows that

$$\sqrt{\frac{1 - Y_k}{X_k}} = 2 \text{ and } \frac{X_k - w(1 - Y_k)}{\sqrt{X_k(1 - Y_k)}} = 2w. \tag{5.18}$$

So, $w = 1/8$ and the selfish member k chooses $Y_k^* = \frac{1}{2} - 4I_k$ to maximize his utility, and when $Y_k \neq Y_k^*$, we have

$$X_k = 1/4(1 - Y_k). \tag{5.19}$$

Substituting Eq. 5.19 into Eq. 5.16 and solving for h_k leads to

$$h_k = \frac{1}{4}(1 - Y_k) - I_k.$$

This equation implies that member k's reward h_k from the family head h is a decreasing function of Y_k, an index which measures how well k is doing in terms of the established value system. Q.E.D.

What the Theorem of Never-Perfect Value Systems implies is that in each civilization, which functions and evolves on a fundamental set of values and philosophical assumption, has to go through moral decline over time because the reward system of the culture in the long run punishes those who actually try to measure up to the requirements and to promote the civilizational values. This fact very well illustrates why each of the transitional changes or blown-ups between the civilizational expansions and contractions represents a weakest link in the whole evolution of the civilization, since the overall moral of the society is at its lows during these time periods.

Let us now go back to our comparison between the West and the East. To improve their living conditions and to resolve the problem of water, for instance, Chinese people realized the desperate need to work together collectively in order to achieve what was desired. Dujiangyan, for example, is an irrigation infrastructure built in 256 BC. It is located along the Min River in Sichuan Province, near the provincial capital Chengdu. For over two thousand years, this irrigation infrastructure has never stopped working and still irrigates over 5,300 square kilometers of land in the region. Because of the successful construction of this project, the originally poor region due to a lack of water in farmlands has ever since become one of the major food production areas of China. During the era of Warring States, the completion of this hydraulic project surely contributed greatly to the success of Qin's eventual unification of China. This simple comparison and yoyo model analysis explain why individualism and other related Western philosophical assumptions are inherently important in European's lives, while collectivism and other values have been vital for Chinese civilization. This end also explains why in the West's conquest of all other civilizations during the past 500 years, the Westerners have had great difficulties to pass on their great values of liberty and individualism to other peoples.

5.5 Existence of Nation States within a Civilization

Human history is composed of stories of civilizations from ancient Sumerian and Egyptian to Classical and Mesoamerican to Christian and Islamic civilizations and through successive manifestations of Sinic and Hindu civilizations. On different perspectives, methodology, focus, and concepts, many distinguished historians, sociologists, and anthropologists have well studied the causes, emergence, rise, interactions, achievements, decline, and fall of civilizations (Kissinger 1994).

The concept of civilization was initially developed by eighteenth century French thinkers; nineteenth century Europeans elaborated the criteria for judging non-European societies as to which were sufficiently civilized to be accepted as members of the European-dominated international system. German thinkers of the nineteenth century distinguished civilizations by mechanics, technology, and material factors, the cultures that involved values and ideals, and the higher intellectual, artistic, moral qualities of a society. Some anthropologists conceived cultures as characteristic of primitive unchanging non-urban societies and complex developed urban and dynamic societies as civilizations. In general, civilization and culture both refer to the overall way of life of a people with a civilization as a culture writ large. They both involve the values, norms, institutions, and modes of thinking to which successive generations in a given society have attached primary importance (Bozeman 1975). By a civilization, it is meant to be a space, a cultural area, a collection of cultural characteristics, and phenomena (Braudel 1980, pp. 177, 202), a particular concatenation of worldview, customs, structures, and culture (both material culture and high culture) which forms some kind of historical whole and which coexists with other varieties of this phenomenon (Wallerstein 1991, pp. 215), and a kind of moral milieu encompassing a certain number of nations, each national culture being only a particular form of the whole (Durkheim and Mauss 1971, pp. 811). For example, blood, language, religion, and way of life were what the ancient Greeks had in common and what distinguished them from the Persians and other nonGreeks. When people are divided by cultural characteristics, they are grouped into civilizations, which are comprehensive, just as the concept of general systems (Lin 1999), none of their constituent units (or elements) can be fully understood in isolation without reference to the encompassing whole (civilization). A civilization is a maximal whole or totality in terms of its fundamental values and philosophical assumptions. Civilizations comprehend without being comprehended by others (Toynbee 1937, p. 455) and (they) have a certain degree of integration. Their parts are defined by their relationship to each other and to the whole. If the civilization is composed of states, these states will have more relation to one another than they do to states outside the civilization. They might fight more, and engage more frequently in diplomatic relations. They will be more interdependent economically. There will be pervading aesthetic and philosophical currents (Melko 1969, pp. 8–9).

For example, European states share cultural features that separate them from others such as Chinese or Hindu communities. And, Chinese, Hindus, and Westerners are not part of any broader cultural entity so that they are from different civilizations. Hence, the concept of civilizations stands for the broadest cultural grouping of people and is defined both by common objective elements, such as language, history, religion, customs, institutions, and by the subjective self- identification of people (Huntington 1996, p. 43). Intuitively, the civilization we belong to represents the biggest "we" within which we feel culturally at home as separated from all "thems" out there. Some civilizations may contain large numbers of people, such as Chinese civilization, and others very small numbers, such as the Anglophone Caribbean. According to the literature, civilizations do not seem to

have clear-cut boundaries, precise endings or beginnings. Throughout history people have redefined their identities and the composition and shape of civilizations have gone through changes over time. Civilizations interact and overlap and are meaningful entities with ambiguous but real dividing line between them.

Civilizations have life of their own. They tend to be long lived by appropriately evolving and adapting to the environment. (For example, virtually all major civilizations of the contemporary world either have existed for a millennium, or as with Latin America, are the immediate offspring of another long-lived civilization.) They represent some of the most enduring forms of human associations and possess long historical continuity, representing the longest story of all (Braudel 1980, pp. 209–210). Bozeman (1992, p. 26) concludes that "international history rightly documents the thesis that political systems are transient expedients on the surface of civilizations, and that the destiny of each linguistically and morally unified community depends ultimately upon the survival of certain primary structuring ideas around which successive generations have coalesced and which thus symbolize the society's continuity."

Now, the following questions naturally arise on the basis of these briefly described understandings of the concept of civilizations.

Question 5.9 How do civilizations or cultures form?

Question 5.10 Why are there nation states within a civilization?

To address these questions, let us continue our analysis given earlier for discussing previous questions. At the start of time when people still lived in the primitive conditions, due to available resources within the natural environment, people formed their elementary beliefs, basic values, and fundamental philosophical assumptions, such as individualism and/or collectivism. Since the population density was low, tools available for purposes of production, conquering the surroundings, etc. were extremely limited and inefficient, minor obstacles of nature in today's standard easily divided people living in the same land into small tribes or groups of tribes. Since these individual and separated tribes or groups of tribes in really lived in the same natural environment, they naturally formed an identical value system and an identical set of philosophical assumptions, on which they reasoned in order to explain whatever inexplicable, developed approaches to overcome hardships, and established methods to administrate members in their individual tribes or groups of tribes. As time went on, better tools for production and transportation and better ways of administration were designed and employed in various individual tribes. The natural desire for better living conditions paved the way for the inventions of new tools, discovery of new methods of reasoning, and the introduction of more efficient ways of administration passed around the land through word of mouth. So, a circulation of people with special skills started to form. Along with these talented people, information, knowledge, and commercial goods were also parts of the circulation. As soon as circulation started to appear, Bjerknes's Circulation Theorem (Hess 1959, Lin, to appear A) guarantees the appearance of abstract eddy motions over the land consisting of migration of

people, spread of knowledge and information, and transportation of goods. That explains how civilizations are initially formed.

If the natural resources of a land were relatively evenly distributed, then the tribes living in the land generally would not need to fight for the control of the resources except for local regions where the available resources were not well distributed among tribes so that the leaders of the tribes had to negotiate and reach an agreement about how to share what was available. At such local regions, much greater centers of power started to form in order to fairly allocate the limited resources and reach satisfactory compromises. Now, let us look at the geographic structure of China. Since most people had to share the resources available only along the two river systems, the Yellow River and the Yangtze River, throughout the recorded history of over 5,000 years, the Chinese had learned how to share by controlling individual behaviors and desires and how to create new resources by collectively and jointly working on such major projects that individuals cannot accomplish. In the contrary, the situation in Western Europe is very different. That was why when Europeans were tired of fighting, there would be a period of time of peace, while throughout Chinese history, no matter how tired people were, they still had to fight until they successfully controlled at least one of the two river systems. This discussion provides an explanation for why there might be nation states within a civilization or why a civilization could possibly be also a nation.

5.6 Multiple Centers or No Centers

Based on what is discovered above, what is interesting at this junction is that the Western civilization has multiple centers or core states, the Sinic civilization has one core state, and the Islamic civilization does not seem to have any core states. That is, the concept of center is at play here. In particular, the Western civilization is multicentered, the Sinic civilization is single centered, and as of most recently, the Islamic civilization still does not seem to "spin" about any of its center. The recent European history and our yoyo model analysis above have well shown the mechanism for the phenomenon of European multiple centers. As for the phenomena of the Sinic single center and the non-existing Islamic center, studies on centralized and centralizable systems may shed some lights for us, for details, see Sect. 5.2.

In particular, Theorems 5.2 and 5.3 provide the theoretical foundation for checking whether or not a civilization that is currently in a chaotic state would soon become organized. When Theorem 5.3 is mapped over to the current state of affairs of the Islamic world, one should be able to see where the Islamic civilization is at in their potential civilizational revival for the ultimate appearance of their powerful civilizational spin field. For our purpose here, all the details are omitted.

As in previously published works on the systemic yoyo model (Lin and Forrest 2008a–c; Lin et al. 2008; Lin 2007; Wu and Lin 2002) and evolutions of weather

systems (Lin 1998a,b; Xiao et al. 1999; OuYang et al. 2000; Lin 2001; OuYang and Lin 2007), a figurative method is majorly employed in this chapter along with methods of microeconomics and general systems theory on top of laboratory experiments for the study of social organizations in general and civilizations in particular. What is important is that we applied the systemic yoyo model, combined with the methods of differential calculus and general systems theory, to address several very intriguing and unsettled problems existing in the research of civilizations. We studied the natural reasons underneath some of the observable phenomena. Because of the innovative application of the systemic yoyo model, we were able to explain the listed mysteries of the international politics from the angle of systems science, natural science, and mathematics. It is our expectation that conclusions in this research derived by using works of systems studies, laboratory experiments, differential calculus, vector analysis, quantitative reasoning of microeconomics, and set-theoretic logic, carry more scientific weight and validity than the traditional language-based analysis that in general is done based on elementary tabulations of very short historical time series data.

Chapter 6
Interaction Between Civilizations

In this chapter, we apply the general thinking logic and methodology of the systemic yoyo model to provide novel resolutions for some of the very important questions studied in the research of history and civilizations regarding the interactions between civilizations. What can be concluded, as shown in the rest of this chapter surely proves the merit of this approach.

Instead of using statistics, this work is among the first of its kind in the study of civilizations that collectively applies rigorous mathematics, the systems research and laboratory experiments in the study of social phenomena. So, when compared to other studies in the area of civilizations that are either language-based or statistics based on using short time-series data, this work brings forward more affirmative conclusions without involving any chance or guess work.

More specifically, it is found that (1) civilizations that are situated in such lands that have severely, unevenly distributed natural resources tend to have higher degrees of unity than those that occupy lands with relatively even distribution of necessities for the existence of ordinary lives; and (2) civilizations existing on rich lands with relatively even distributions of natural resources tend to have multiple centers (or called core states). As for how a civilization disappears (or dies), our analysis indicates that the civilizational yoyo structure has to stop spinning completely and there are several possible means for this end to happen: (i) The amount of materials in the spin field of the civilizational yoyo structure is significantly reduced to such a level that it can no longer form a spinning whole; (ii) The fundamental set of values and philosophical assumptions has to be broken into unrelated pieces so that different entities are formed, and (iii) The natural environment goes through drastic changes so that the long-held system of beliefs is no longer true. Here, the First Law on State of Motion (Lin 2007) is employed.

To settle the problem of how a new emerging or reviving civilization adopt elements of other existing civilizations to build or reconstruct its own organizational structure, the structures and mutual interactions of spinning yoyos are readily employed to provide convincing explanations.

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When looking at the global identity crisis that appeared at the end of the Cold War, our analysis on the basis of the dishpan experiments (Hide 1953; Fultz et al. 1959; Lin to appear A) indicates that in today's world, there is still a temperature difference between the equator and the polar areas and the surface of the earth is not nearly as smooth and symmetric as the bottom of the dish used in the dishpan experiments, that explains why after one superpower disappears, the world fell into an identity crisis by addressing the question: who are we? Even the United States, the surviving superpower, had to face the identity crisis. The current study indicates that the current world is on the verge of entering one gigantic "whirlpool" motion around the "polar circle," and that if the temperature difference between the equator and the north (and the south) pole in the coming years, decades fluctuate around this current range, the world politics will stabilize in a truly multipolar state. This conclusion means that the appearance of the global identity crisis in the 1990s is an indicator for the United States to cease its global dominance as the sole superpower.

To address the question of how to separate one civilization from another, one only need to look at the natural environment and geographic conditions in which people live. About the interaction between civilizations, our analysis on the factors that contribute to the isolation of a civilization from the rest of the world, such as in the cases of China and Japan in history, shows that when outside forces, which try to act upon these countries, were relatively weak, the rulers of these and other similar countries would like to cut off the cultural connections from within the countries with the outside world. By doing so, these rulers could potentially strengthen their control of the respective countries. However, as a consequence of doing so, as suggested by the Theorem of Never-Perfect Value Systems, the originally great and prosperous civilization will soon face its dismay by going through a transitional change (blown-up). That will be when the society has to open up itself once again to accept useful and beneficial elements from other powerful and prospering civilizations.

When considering conflicts between peoples, among other questions, we look at: How are enemies of people defined? Why do people need enemies in their identity search? To this end, we make use of the concept of stirring energy and its conservation. By focusing on three-ringed circulations, it is shown that each transformation or transfer of stirring energy is carried out and completed through the second-level circulations, and between the first-level and third-level circulations, there does not exist any energy transformation or transfer. If the second-level circulation cannot materialize transformation and transfer of energies, energy blockage will have to be created, leading to instabilities in the accumulation of energy and triggering the third-level circulation to destroy the original second-level circulation in order to achieve the system's equilibrium and stability. Since between any two people, as well shown by our analysis, there always exist common interests and conflicts at the same time, no people can reasonably use conflicts or common interests as its basis for identifying enemies. Instead, our work shows why between different cultures, there does not exist any eternal friendship other than common interests and constant conflicts. On the other hand,

to define enemies, people only need to single out those out there who seemingly attempt to destroy the temporarily stable three-ringed circulation structure existing in its yoyo spin field, since this three-ringed circulation structure is the guarantee for the stable existence, even though this stable existence is only for a very short period of time in terms of the whole evolution, of the people itself and its underlying civilization. When people search for their identities, they are in fact looking for the currently existing three-ringed stable circulation structure in their civilizational yoyo structure. However, in terms of whole evolutions of systems, stability exists only temporarily with change being the absolute. So, when people can finally identify themselves with a relatively stable entity and feel proud of their association with that entity, they are keen about those people who might potentially damage or seem trying to destroy their chosen entity.

This chapter is organized as follows. Section 6.1 addresses the issue about the fate of civilizations. Section 6.2 considers how and when one civilization adopts beneficial elements from others. The appearance of a forthcoming world of multipolar politics is predicted in Sect. 6.3. Section 6.4 provide a way to tell one civilization apart from another. Section 6.5 studies the reason why each civilization experiences pressures from outside organizations and when and why a civilization might choose to isolate itself from the rest of the world. Section 6.6 develops an answer to why people need enemies and how enemies are defined. Once again, to take advantage of available mathematical tools, the assumptions of continuity and differentiability are assumed as needed.

6.1 The Fate of a Civilization

Civilizations move through seven stages: mixture, gestation, expansion, age of conflict, universal empire, decay, and invasion (Quigley 1961, p. 146ff); Each civilization arises as a response to challenges and then goes through a period of growth involving increasing control over its environment produced by a creative minority, followed by a time of troubles, the rise of a universal state, and then disintegration (Toynbee 1934–1961, p. 569ff). For example, the Western civilization began to take shape between A.D. 370 and 750 through the mixing of elements of Classical, Semitic, Saracen, and barbarian cultures. Its period of gestation lasting from the middle of the eighth century to the end of the tenth century was followed by movement back and forth between phases of expansion and phases of conflict. The West now appears to be moving out of its phase of conflict, Western civilization has become a security zone and intra-West wars are virtually unthinkable. The West is developing its equivalent of a universal empire in the form of a complex system of confederations, federations, regimes, and other types of cooperative institutions that embody at the civilizational level its commitment to democratic and pluralistic policies. The West has become a mature society entering into what future generations will look back to as a golden age a period of peace, resulting from the absence of any competing units within the area

of the civilization itself, and from the remoteness or even absence of struggles with other societies outside. It is also a period of prosperity that arises from the ending of internal belligerent destruction, internal trade, the establishment of a common system of weights, measures, and coinage, and from the extensive system of government spending associated with the establishment of a universal empire. In other past civilizations, this phase of blissful golden age with its visions of immortality has ended either dramatically and quickly with the victory of an external society, or slowly and equally painfully by internal disintegration.

Civilizations grow, because they have an instrument of expansion, such as a powerful military, a religious, political, or economic organization that accumulates surplus and invests it in constructive productions. Civilizations decline when they stop the application of surplus to new ways of doing things. In modern times, we see that the rate of investment decreases, this happens because the social groups controlling the surplus have a vested interest in using it for nonproductive but ego-satisfying purposes…which distribute the surpluses to consumption but do not provide more effective methods of production. People live off their capital and the civilization moves from the state of the universal state to the stage of decay. This is a period of acute economic depression, declining standards of living, civil wars between the various vested interests, and growing illiteracy; the society grows weaker and weaker. Vain efforts are made to stop the wastage of legislation, but the decline continues, the religious, intellectual, social, and political levels of the society began to lose the allegiance of the masses of the people on a large scale. New religious movements begin to sweep over the society; there is growing reluctance to fight for the society or even to support it by paying taxes. Decay then leads to the stage of invasion when the civilization, no longer able to defend itself because it is no longer willing to defend itself, lies wide open to 'barbarian invaders,' who often come from another younger, more powerful civilization (Quigley 1961).

Since the mid 1990s, the West has had many characteristics as Quigley identified as those of a mature civilization on the brink of decay. For example, economically, the West is far richer than any other individual civilization, however, with low economic growth rates, savings rates, and investment rates; individually and collectively, consumption has priority over the creation of capabilities for future economic and military power; and demographically, natural population growth was low. And, far more significant than the economic and demographic problems are those of moral declining, cultural suicide, and potential disunity of the West. Some of the manifestations of moral decline include: (1) increases in antisocial behavior; (2) family decay; (3) a decline in social capital, that has membership in voluntary associations and the interpersonal trust associated with such memberships; (4) general weakening of work ethic and the rise of a cult of personal indulgence; and (5) decreasing commitment to learning and intellectual activity.

The political composition of civilizations varies from one civilization to another and varies over time within a civilization. A civilization may contain a few or many political units. These units may be city states, empires, federations,

confederations, nation states, multi-national states, all of which may have varying forms of government. As a civilization evolves over time, changes normally occur in the number and nature of its constituent political units (Huntington 1996, p. 44). China is a civilization that pretends to be a state; Japan is a civilization that is a state. In modern world, most civilizations contain two or more states or political entities (Pye 1990). There are at least twelve major civilizations throughout history, seven of which no longer exist (Mesopotamian, Egyptian, Cretan, Classical, Byzantine, Middle American, and Andean) and five which do (Chinese, Japanese, Indian, Islamic, and Western). To these five civilizations, it is useful in the contemporary world to add orthodox Latin American, and, African civilizations (Melko 1969, p. 133; Huntington 1996, p. 45).

Question 6.1 What factors determine a civilization either to live or to die?

To answer this question, we need to place civilizations in the historical flow of time and see each civilization as a spinning yoyo coexisting with many other civilizational yoyos. By doing so, our earlier systemic yoyo analysis indicates that as long as a civilization has uneven internal organization, there must be uneven moments of forces. Combining with the naturally existing uneven gradient forces produced by the uneven internal organization, the abstract but realistic yoyo structure of the civilization will have to spin. That is, the uneven internal organization of an entity produces eddy motion for the entity. And, the more uneven internal organization the entity possesses, the greater the naturally existing uneven gradient forces will be, and the faster the entity will spin. In a fast spinning civilization, where the high speed of rotation represents a high degree of unity of the underlying civilization, the number of political units changes over time just as what is shown in the dishpan experiment (Hide 1953; Fultz et al. 1959; Lin to appear A). This analysis also indicates that it is also possible for a civilization to have many political units as long as the overall internal organization of the civilization is relatively even. This end combined with what is obtained earlier in Lin and Forrest (to appear a) leads to the following conclusions:

(1) Civilizations that are situated in such lands that have severely, unevenly distributed natural resources tend to have higher degrees of unity than those that occupy lands with relatively even distribution of necessities for the existence of ordinary lives;
(2) Civilizations existing on rich lands with relatively even distributions of natural resources tend to have multiple centers (known as core states).

The organizational unevenness of a civilization makes the civilizational yoyo spin. Through transformations between the opposite spinning directions of rotational duality (eddy motions exist in pairs), energies are transformed and transferred so that new uneven organizations are created. Through existence of temporary stable organizations and instable evolutionality of organizations, civilizations evolve through history. So, for a civilization to disappear (or die), its yoyo structure has to stop spinning completely. There are several possible means for this end to happen:

(i) The amount of materials in the spin field of the civilizational yoyo structure is significantly reduced to such a level that it can no longer form a spinning whole;
(ii) The fundamental set of values and philosophical assumptions has to be broken into unrelated pieces so that different entities are formed; and
(iii) The natural environment goes through drastic changes so that the long-held system of beliefs is no longer true.

All these three conditions can be created humanly with the help of modern technology or through the mercy of the nature. However, we have the following law:

The First Law on State of Motion (Lin 2007): *Each imaginable and existing entity in the universe is a spinning yoyo of a certain dimension. Located on the outskirt of the yoyo is a spin field. Without being affected by another yoyo structure, each particle in the said entity's yoyo structure continues its movement in its orbital state of motion.*

That is, conditions (i)–(iii) listed above can only be met from outside the civilizational yoyo; Here, we will not go into further details.

6.2 Evolution of Civilizations Through Adopting Beneficial Elements

Americans consumed millions of Japanese cars, cameras, television sets, and electronic gadgets during the 1970s and 80s, which created considerable antagonism toward Japan, and lived off Chinese goods starting in late 1980s, which similarly led to resentment toward the Chinese. In 1993, 88 of the hundred films most attended throughout the world were American, and two American and two European companies dominated the collection and dissemination of news on a global basis (Havel 1995), which also seemed to have produced alienation from across the world against America. So, considering the emerging West in the eleventh and thirteenth centuries, we have to ask:

Question 6.2 How does a new emerging or reviving civilization adopt elements of other existing civilizations to build or reconstruct its own organizational structure?

For a new emerging or reviving civilization to adopt elements of different existing or other civilizations, the specific civilization has to be either created or reconstructed with the objects m out of scenarios of Figs. 6.1b, c and 6.2a, d. For scenarios in Figs. 6.1a, d and 6.2b, c no viable subeddies can be fruitfully produced. If a subeddy is indeed created in cracks between existing spinning fields, elements of these civilizations useful to the newborn might not be naturally adopted by the subeddy. They could also be forced on to the offspring. For example, Japan's forcible opening to the West by Commodore Perry in 1854

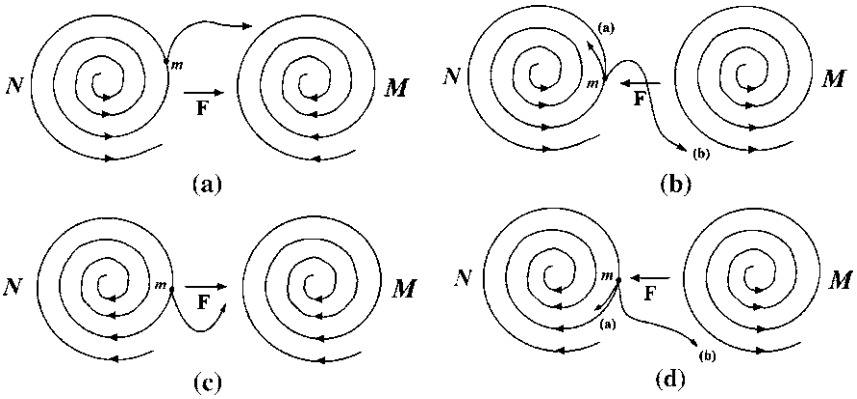

Fig. 6.1 Acting and reacting models with yoyo structures of harmonic spinning patterns. **a** Object *m* is located in a diverging eddy and pulled by a converging eddy *M*. **b** Object *m* is located in a diverging eddy and pulled or pushed by a diverging eddy *M*. **c** Object *m* is located in a converging eddy and pulled by a converging eddy *M*. **d** Object *m* is located in a converging eddy and pulled by a diverging eddy *M*

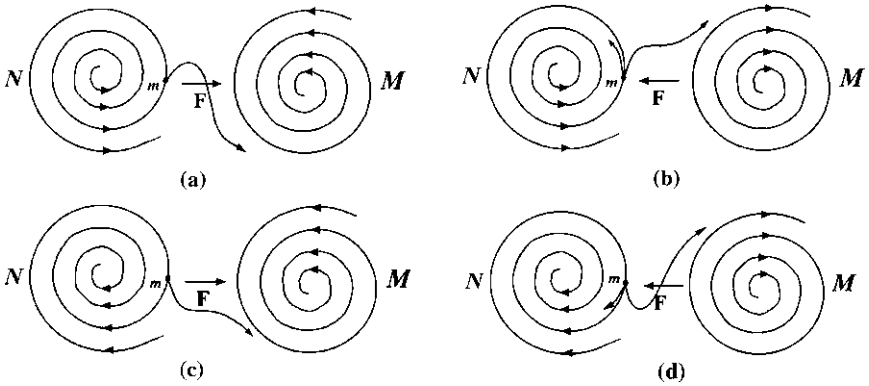

Fig. 6.2 Acting and reacting models with yoyo structures of inharmonic spinning patterns. **a** Object *m* is located in a diverging eddy and pulled by a converging eddy *M*. **b** Object *m* is located in a diverging eddy and pulled by a diverging eddy *M*. **c** Object *m* is located in a converging eddy and pulled by a converging eddy *M*. **d** Object *m* is located in a converging eddy and pulled by a diverging eddy *M*

vividly shows that after tasting the greatness of the Western civilization by external force or pressure, Japan voluntarily made its dramatic decision to learn from the West following the Meiji Restoration in 1868. Other than the potential scenario for a new civilization to be born as shown in Fig. 6.3, other possibilities are given in Fig. 6.4.

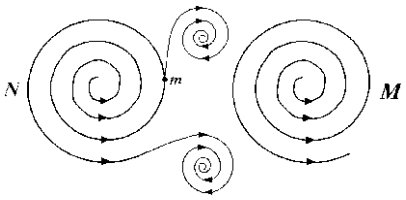

Fig. 6.3 Object *m* might be thrown into a sub-eddy created by the spin fields of *N* and *M* jointly

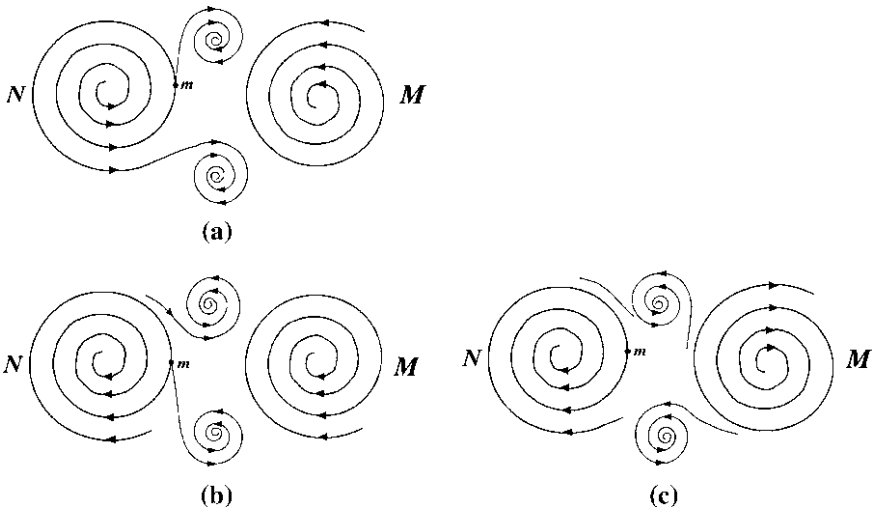

Fig. 6.4 Additional ways for new civilizations to be created by the spin fields of *N* and *M* jointly. **a** Object *m* is situated as in Fig. 6.2a. **b** Object *m* is situated as in Fig. 6.1c. **c** Object *m* is situated as in Fig. 6.2d

6.3 Appearance of a World of Multi-Polar Politics

Since the time when the Cold War ended, every state has been trying to address the question: Who are we? It is because the answer reflects the state's cultural identity, defines its place in world affairs, and pinpoints to its potential friends and enemies. Since the collapse of the Soviet Union in the 1990s, history has witnessed the erupt appearance of a global identity crisis. The countries suffering from the identity crisis included Algeria, Canada, China, Germany, Great Britain, India, Iran, Japan, Mexico, Morocco, Russia, South Africa, Syria, Tunisia, Turkey, the Unites States, and others.

In coping with the identity crisis of the 1990s, associations are created based on blood, belief, faith, ancestry, religion, language, values, and institutions. People with differences in these areas are separated further from each other. Once again in history, civilizational "we" and external "they" are clearly addressed. As soon as

the ideological struggle of the Cold War was over, "we" began to feel more superior than "they," "they" do not have "our" trust, "they" cannot speak "our" civilized language, and "they" do not even have the very same underlying values, motivations, social relationships as "we" have. For instance, Europe's boundaries on the North, West, and South are delimited by substantial bodies of water, which to the South coincides with clear differences in culture; to the east, the boundary starts in the north and runs along what are now the borders between Finland and Russia and the Baltic states (Estonia, Latvia, Lithuania) and Russia, through western Belarus, through Ukraine separating the United west from the Orthodox east, through Romania between Transylvania with its Catholic Hungarian population and the rest of the country, and the former Yugoslavia along the border separating Slovenia and Croatia from the other republics. In the Balkans, this line coincides with the historical division between the Austro-Hungarian and the Ottoman Empire (Huntington 1996, p. 158). This identification of Europe provides clear criteria for the admission of new members to Western organizations.

Along with the identity crises, a societal cold war in which the Europe could be in the front line between the West and Islam has been increasing its intensity. It is now stretching from the Atlantic in the West to China in the East (Lewis 1990; Sid-Ahmed 1994).

Question 6.3 Is the appearance of the global identity crisis in the 1990s an indicator for the United States to cease its global dominance as the sole superpower?

Since we all the human beings are part of the nature. Whatever we do or think about doing is a reflection of some fundamental changes occurring in nature, for details see discussions of blown-up theory in (Wu and Lin 2002). The dishpan experiment (Hide 1953; Fultz et al. 1959; Lin to appear A) suggests that as the temperature difference between the polar circle and the periphery decreases, the number of eddy leaves decreases; if the temperature difference disappears, the fluid in the spinning dish flow around the polar circle as a large whirlpool. So, if we look at the human race from above the North Pole as what Hide, Fultz, and their colleagues did when they conducted their experiments to simulate the airflows over the earth, we can then easily see that the current global warming must be the significant contributing factor that helped to make the international politics (the fluid) around the world (the dish) flow more evenly. However, what is different of the scenario of the dishpan experiment without any temperature difference between the polar circle and the periphery is that in today's world, there is still a temperature difference between the equator and the polar areas and the surface of the earth is not nearly as smooth and symmetric as the bottom of the dish used in the experiment. That explains why after one superpower disappears, the world fell into an identity crisis. Even the United States, the surviving superpower, has to face the identity crisis. Based on our yoyo model analysis, the current world is on the verge of entering one gigantic "whirlpool" motion around the "polar circle." However, the temperature difference still exists and the surface of the earth is full of asymmetries when compared to the dish in the dishpan

experiment. So, people living in different natural environments suddenly become more aware of their differences, created out of the environments they live in. If the temperature difference between the equator and the north (and the south) pole in the coming years, decades fluctuate around this current range, the world politics will stabilize in a truly multi-polar state. This end answers our question affirmatively: Yes, the appearance of the global identity crisis in the 1990s is indeed an indicator for the United States to cease its global dominance as the sole superpower, because if the United States is seen as a spinning whirlpool, then there must be at least another pool that spins in the opposite direction, since eddies must appear in duality.

6.4 Separation of Civilizations From Each Other

Our yoyo model analysis and discussion lead naturally to explanations on how civilizations are separated from each other. In particular, a good indicator for telling different civilizations apart from each other is the natural environment and geographic conditions in which people live. For example, let us think of some islanders who are cut off from other varieties of environmental conditions by large bodies of water. If throughout history their closest neighboring lands are always occupied by well-formulated civilizations (vigorously spinning yoyos), then the islanders (constituting a small and barely spinning yoyo) have no alternative other than forming their own civilization while periodically absorbing useful and beneficial elements from the neighboring civilizations. And when the neighboring civilizations (as seen as spinning fluids in the dishpan experiment) experience internal chaos (that is when the spinning fluids contain traveling eddy leaves), the small civilizational yoyo of the islanders might have the opportunity to expand temporarily onto the land occupied by the organizationally chaotic people.

6.5 External Pressures and Internal Decisions

As what is shown in Lin and Forrest (to appear), for two-dimensional eddy currents, positive and negative (that is, converging and diverging) rotations are transformed into each other alternately by going through transitional changes (blow-ups). So, in a world that is filled with many co-existing civilizational, spinning yoyo fields, the rise and fall of a civilization are simply parts of the natural cycle of the civilization's evolution with the time periods of transitional changes (blown-ups) as the weakest links of the whole evolution of each civilization, as indicated by the analysis based on the Theorem of Never-Perfect Value Systems (Lin and Forrest to appear a; Lin and Forrest 2008b). Also, interactions between civilizations exist universally (since the spinning fields and meridian fields of the yoyo structures extend infinitely into the space) so that elements of

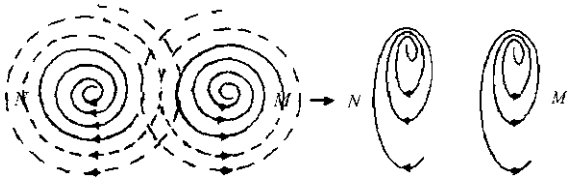

Fig. 6.5 Imaginary action and reaction spin fields of our solar system *M* and a neighboring system *N*

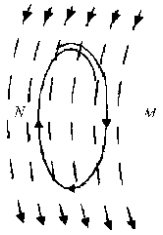

Fig. 6.6 The effect of the spin field of *M* on one loop of *N*

one civilization are constantly imposed on other civilizations and each civilization relentlessly experiences novel ideas from other civilizations that are not provable within their own systems of values and philosophical assumptions. In particular, when two civilizations *N* and *M* coexist side by side (Fig. 6.5), their infinitely expanding eddy fields have an interference with each other so that their action and reaction pressure their would-be circular motions into elliptical motions. So, the practical operations of the basic values and fundamental philosophical assumptions of one civilization are greatly affected by those of the other civilization as shown in Fig. 6.6, where we took out one loop from the spin field of *N* in Fig. 6.5 and take a closer look. The downward motion along the loop of *N* on the right-hand side is helped by the spin field of *M* (some novel elements of *M* that are not provable in *N*). At the same time, the upward traveling on the left-hand side of the loop of *N* has to overcome the encountering effects of *M*'s spin field (those *M*'s novel but not provable elements in *N*). So for the civilization *N* to evolve smoothly (not necessarily for its ultimate survival), it would naturally absorb some of those novel elements from other civilizations. Similarly, the same also holds true for the civilization *M*.

This discussion also helps us understand why a civilization might choose to isolate itself from other civilizations such as China and Japan in history. In particular, if the spin field *N* in Fig. 6.5 stands for a civilization that is naturally separated from all other similar size civilizations except some minor connections (controllable from within by *N*) with some of the similar size civilizations, then to a degree, *N* would become content with how circular its spin field is (this happens only when this civilization is at its peak strength and prosperity), since in this case, the behaviors and the system of values and philosophical assumptions of *N* would not be placed under any pressure from or scrutiny of other civilizations as analyzed above. Combining this conclusion with the descriptions about China's and Japan's natural surroundings (for details, see Lin and Forrest (to appear a and d)), when outside forces, which try to act upon these countries, were relatively weak, the

rulers of these and other similar countries would like to cut off the cultural connections from within the countries with the outside world. By doing so, these rulers could potentially strengthen their control of the respective countries. However, as a consequence of doing so, as suggested by the Theorem of Never-Perfect Value Systems (Lin and Forrest 2008b), the great and prosperous civilization will soon face its dismay by going through a transitional change (blown-up). That will be when the society has to open up itself to accept useful and beneficial elements from other powerful and prospering civilizations.

6.6 Natural Existence of Enemies

For the post-Cold War world, when people are seeking identities and reinventing ethnicities, they need enemies, as Huntington (1996, p. 20) claims that "enemies are essential, and the potentially most dangerous enmities occur across the fault lines between the world's major civilizations." "Cultural conflicts are increasing and are more dangerous today than at any time in history" (Havel 1995), and "future conflicts will be sparked by cultural factors rather than economics or ideology" (Delors 1993). For example, the civilizational clashes in Bosnia, the Caucasus, Central Asia, or Kashmir have the potential to become bigger wars. In the Yugoslav conflicts, Russia provided diplomatic support to the Serbs, while Saudi Arabia, Turkey, Iran, and Libya offered finance and arms to the Bosnians due to the underlying cultural kinship.

Question 6.4 How are enemies of people defined? Why do people need enemies in their identity search? Answers to these questions might lead to an explanation as for why "potentially most dangerous enmities occur across the fault lines between the world's major civilizations."

To help address this question, let us look at the concept of stirring energy (OuYang to appear A) and its conservation (OuYang to appear B).

Based on our systemic yoyo model, the common and basic momentums and kinetic energies in the universe are the stirring (or rotational) momentum ($m\omega$) and the stirring (or rotational) kinetic energy ($m\omega^2$), comparing to the traditional irrotational momentum (mv) and the irrotational kinetic energy (mv^2), created by the angular speed ω of the rotational stir of the material m's structures existing in a curvature (non-Euclidean) space. With this understanding in place, we are able to shed new light on how energies change, in which forms energies transform and are transferred, and the processes of energy transformation and transfer, all of which have been missing in modern science. For instance, Newton's third law of mechanics only spells out the impact or the consequence of the interaction without providing us with any information on the form of motion and the process of interaction.

In terms of quantities, angular speed measures the rotation of materials, while (linear) speed is the measurement of linear distance traveled by an object within the unit time. That is,

$$\vec{\omega} = \vec{i}\omega_x + \vec{j}\omega_y + \vec{k}\omega_z. \tag{6.1}$$

Due to the unevenness of the spatial distribution of linear speed, the angular speed can be written as follows:

$$\vec{\omega} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ u & v & w \end{vmatrix}, \tag{6.2}$$

where u, v, and w are respectively the x-, y-, and z-components of the vector $\vec{V}$. For the horizontal two-dimensional plane, the angular speed in the vertical direction is

$$\omega_z = \frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}. \tag{6.3}$$

Introducing the flow function ψ gives

$$v = \frac{\partial \psi}{\partial x} \text{ and } u = -\frac{\partial \psi}{\partial y}.$$

Assume that ψ can be represented as simple harmonic disturbances. Looking at the whole system, let us introduce the combined disturbance of various scales: $\psi = \sum_n \psi_n$. Then, we have

$$\nabla^2 \psi_n = -\mu_n^2 \psi_n. \tag{6.4}$$

Considering the horizontal problem, let's take $V^2 = (\nabla\psi)^2$. From Eqs. 6.3 and 6.4, it follows (OuYang et al. 2002) that

$$\oint\!\!\!\!\!\!\int_{\sigma} V_n^2 \, d\sigma = \oint\!\!\!\!\!\!\int_{\sigma} \left(\sum_n \mu_n^2 \ \psi_n^2 \right) d\sigma, \tag{6.5}$$

and

$$\oint\!\!\!\!\!\!\int_{\sigma} \omega_z^2 d\sigma = \oint\!\!\!\!\!\!\int_{\sigma} \left(\sum_n \mu_n^2 \cdot (\mu_n^2 \psi_n^2) \right) d\sigma$$

By substituting Eq. 6.5 into this last equation, we have

$$\oint\!\!\!\!\!\!\int_{\sigma} \omega_z^2 d\sigma = \oint\!\!\!\!\!\!\int_{\sigma} \left(\sum_n \mu_n^2 V_n^2 \right) d\sigma. \tag{6.6}$$

By comparing Eqs. 6.5 and 6.6, it can be seen that the closed line integral of the squared rotational angular speed contains the traditional closed line integral of the squared speed. That implies that the concepts of linear speed and angular speed have different physical meanings. What is very interesting is that a conservation of

stirring energy not only contains the conservation of linear speed kinetic energy, but also shows the way and procedure of the kinetic energy's transformation and transfer.

Since in nature, we often observe three-ringed stabilities, for example,

(1) Cosmic galaxy systems, star systems, and planetary systems, can be stably observed with the star systems being the second-level circulations concentrated with the main materials and energies of the universe;
(2) The microscopic scales of materials consist of the molecular systems, atomic systems, and electronic systems, where what is interesting is that the atomic scale systems, as the microscopic second-level circulations, also possess high concentrations of energy with the theory of nuclear energy proven;
(3) In the scale of human activities or the so-called meso-scale systems, we can observe the three-leveled circulation system of frigid zones, temperate zones, and torrid zones. Here, the temperate zones contain the major amounts of energy;
(4) Each typhoon (or hurricane) is also a three-leveled circulation system, consisting of the typhoon eye, the region of torrential rains and high-speed winds, and the outer-ring-shaped region of subtropical high pressures. Once again, it is the second-level circulation area that holds high concentrations of energy.
(5) Each empire is composed of the main territory and body of citizens, the far-reaching economic, military, and cultural influences on other peoples, and the pressure imposed on other peoples to conform to the desires and wants of the empire. Here, it is the second-level circulation of the far-reaching influences that carry the highest concentration of energy.

These observations seem to suggest that the quasi-stable existence of natural materials and organizations needs at least three levels of circulations with the middle-level circulations holding huge amounts of energy. So, we can see that three-leveled circulations, shown in each energy transformation, have played the role of coordinating and restraining the energy transformation for the underlying stable existence, the destructive nature of non-three-leveled circulations leading to instable evolutions, and the dynamic equilibrium that without eddy motions there will be no kinetic energy transformation and the amount of kinetic energy determines the internal heat of the eddy motions (OuYang 1998).

For a given three-ringed circulation, if we look at the second-level circulation, from Eq. 6.5 and the conservation of stirring energy in Eq. 6.6, the conservation of kinetic energy implies

$$\begin{cases} \mu_1^2 \Delta v_1^2 + \mu_2^2 \Delta v_2^2 = 0 \\ \Delta v_1^2 + \Delta v_2^2 = 0. \end{cases} \tag{6.7}$$

where Δv^2 stand for the changes in the speed kinetic energy from one time moment to the next neighboring moment. By eliminating Δv_1^2 and Δv_2^2 respectively in Eq. 6.7, we obtain

$$\left(\mu_2^2 - \mu_1^2\right)\Delta v_2^2 = 0 \text{ and } \left(\mu_1^2 - \mu_2^2\right)\Delta v_1^2 = 0. \tag{6.8}$$

Since $\mu_1 \neq \mu_2$, Eq. 6.8 implies that it must be $\Delta v_1^2 = \Delta v_2^2 = 0$. This end implies that with second-level circulations only, no energy transformation and transfer can be carried out, causing blockage or high concentration of energies and consequently, instable evolution has to take place. From this explanation, it can be seen why each naturally existing river in the northern hemisphere has naturally formed lakes on the right bank along its course to dredge locally blocked accumulation of energy.

If we introduce a third-leveled circulation, from Eqs. 6.5 and 6.6 we then have

$$\begin{cases} v_1^2 + v_2^2 + v_3^2 = c_1 = \text{const} \\ \mu_1^2 v_1^2 + \mu_2^2 v_2^2 + \mu_3^2 v_3^2 = c_2 = \text{const}, \end{cases} \tag{6.9}$$

To satisfy the law of conservation we must have

$$\begin{cases} \mu_1^2 \Delta v_1^2 + \mu_2^2 \Delta v_2^2 + \mu_3^2 \Delta v_3^2 = 0 \\ \Delta v_1^2 + \Delta v_2^2 + \Delta v_3^2 = 0. \end{cases} \tag{6.10}$$

By eliminating Δv_1^2, Δv_2^2, and Δv_3^2 respectively in Eq. 6.10, we obtain

$$\begin{cases} \left(\mu_1^2 - \mu_2^2\right)\Delta v_2^2 + \left(\mu_1^2 - \mu_3^2\right)\Delta v_3^2 = \mu_1^2 c_1 - c_2 = \text{const} \\ \left(\mu_2^2 - \mu_1^2\right)\Delta v_1^2 + \left(\mu_2^2 - \mu_3^2\right)\Delta v_3^2 = \mu_2^2 c_1 - c_2 = \text{const} \\ \left(\mu_1^2 - \mu_3^2\right)\Delta v_1^2 + \left(\mu_2^2 - \mu_3^2\right)\Delta v_3^2 = c_2 - \mu_3^2 c_1 = \text{const}. \end{cases} \tag{6.11}$$

Assume $\mu_1 > \mu_2 > \mu_3$ (the same results follow, if we let $\mu_1 < \mu_2 < \mu_3$). Then, the coefficients on the left-hand sides of the first and the third equations in Eq. 6.11 are positive and those on the left-hand side of the second equation are negative. So, we have

(1) Both Eqs. 6.7 and 6.10 indicate that the conservation of the pure linear speed kinetic energy cannot limit the dissemination of energies. It is because beyond the speed kinetic energy, there is still the spread of stirring energy.
(2) When both v_1^2 and v_3^2 decrease, v_2^2 will increase. Conversely, when v_1^2 and v_3^2 increase, v_2^2 will decrease. That is, the three-ringed circulation can through the second-level circulation complete its energy transformation and transfer with such a process that it is clearly shown.

(3) If $\mu_2^2 - \mu_3^2 < 0$, when v_1^2 increases, so does the corresponding v_3^2. Conversely, when v_1^2 decreases, v_3^2 also decreases.

This analysis indicates that each transformation and transfer of stirring energy is carried out and completed through the second-level circulations, and between the first-level and third-level circulations, there does not exist any energy transformation or transfer. That is, our discussion explains not only that the conservation of the irrotational kinetic energy is unable to restrict instabilities, but also that the existent instable energies constitute the mechanism of transfer of realistic physical processes. If the second-level circulation cannot materialize transformation and transfer of energies, energy blockage will have to be created, leading to instabilities in the accumulation of energy and triggering the third-level circulation to destroy the original second-level circulation in order to achieve the system's equilibrium and stability. The transformation and transfer of circulative energies affirm the cause for materials' stable existence through the conservation of the quasi-three-ringed stirring energy. Due to the capabilities of indirect circulations, between the first-leveled and the third-leveled circulations there does not exist direct energy transfers. The inevitable consequence is that the first-leveled circulation "moves," while the third-leveled circulation "does not move." When the second-leveled circulation accommodates the retransfers of energy from the first-leveled circulation, it at the same time transfers to both the first- and third-level circulations so that a transfer of energy is completed in the form of dispersion.

Each three-leveled circulation transformation constitutes a quasi-closed system, completing transformations and transfers of energies. The fourth-level, fifth-level, and any other higher-level circulations at most receive or further transfer the remnant energy out of the three-leveled circulation without being able to constitute a system's quasi-stability. And, the mechanism of physical adaptation process is that instable sub-circulations readjust themselves to the primary three-leveled circulation. All sub-circulations, which do not follow the three-ringed energy transformations, are not stable. And, the instability of the fourth or higher-level circulations would adjust themselves toward the quasi-stability of a three-ringed circulation. This end can be observed in the evolution of the realistic atmospheric circulations and the dishpan experiment (OuYang et al. 2002). What needs to be pointed out is that stability is relative and according to the point of view of evolution, there exists absolutely no stability. Any stability can be destroyed by the instability of the underlying system's non-three-ringed circulations. However, because of the conservation of stirring energies, each instability must adjust itself toward a three-leveled circulation. And the readjusted three-leveled circulations might not be the same as the original system's three-ringed circulation. So, instabilities and conservation of stirring energies not only are the reason for the existence of materials' and events' forms, structures or attributes, but also reveals the evolutionary process from the start of the development to the end of a change.

Now, in terms of how people define their enemies and why any people need enemies in their identity search, from the analysis of Figs. 6.5 and 6.6, it follows that between any two people, there always exist common interests (when their spin fields reinforce on each other and make both of the fields rotate stronger and faster) and conflicts (when their spin fields act against each other making both fields move slower and more difficult) at the same time. So, no people can reasonably use conflicts or common interests as its basis for identifying enemies. Instead, this analysis shows why between different cultures, there does not exist any eternal friendship other than common interests and constant conflicts. To define enemies, people only need to single out those out there who seemingly attempt to destroy the temporarily stable three-ringed circulation structure existing in its yoyo spin field, since this three-ringed circulation structure is the guarantee for the stable existence, even though it is only for a very short period of time in terms of the evolutionary history, of the people itself and its underlying civilization. When people search for their identity, they are in fact looking for the currently existing three-ringed stable circulation structure in their civilizational yoyo structure. However, in terms of whole evolutions of systems, stability exists only temporarily with change being the absolute. So, when people can finally identify themselves with a relatively stable entity and feel proud of their association with that entity, they are keen about those peoples who might potentially damage or seem trying to destroy their chosen entity. This end explains why "potentially most dangerous enmities occur across the fault lines between the world's major civilizations," because only the yoyo spin fields of major civilizations would act on each other in ways that seem to destroy each other, since they are human organizations established on very different and maybe even contradictory systems of values and philosophical assumptions.

Those who are familiar with the literature in the area of the study of civilizations can surely confirm that the methods employed in this work and the results obtained here are very different of those in the current publications, where the traditional language-based analysis that in general is done based on elementary tabulations of very short historical time-series data has been commonly employed. As what was pointed out in Lin and Forrest (to appear d), the approach we used here is the traditional deterministic one without involving any statistical uncertainty. However, due to the use of the spinning yoyo model, true uncertainties are considered when interactions between spinning yoyos are concerned with. These interactions are exactly the places where the traditional quantitative method of analysis, including the statistical methods, loses its validity (OuYang and Lin 2007). In particular, what is important about our works here is that we applied the systemic yoyo model to the study of civilizations by addressing a whole sequence of unsettled questions regarding the natural reasons underneath some of the observable phenomena. Because of the innovative application of this systemic yoyo model, we were able to explain many mysteries of the international politics

from the angle of systems science, natural science, and mathematics. It is our expectation that conclusions in this research derived by using works of systems studies, laboratory experiments, differential calculus, vector analysis, quantitative reasoning of microeconomics, and set-theoretic logic, carry the needed scientific weight and validity for scholars and practitioners at the various organizational levels to base their decisions on our studies.

As a future topic of research, it will be thought provoking to look at the whole evolution of each civilization that ever existed in the history using the method we established in this chapter and in Lin and Forrest (to appear a and d).

Chapter 7
Turmoil Within a Civilization

In this chapter, we will see how the systemic yoyo model and relevant results can be beautifully employed in the study of the peace and harmony between civilizations, and chaos experienced by civilizations, how economic prosperities travel, and how Westernization and modernization are related.

In particular, we show that the "illusion" of peace and harmony felt after major conflicts in the twentieth century is a physical reality, representing a relatively even "rotation" of the "whirlpool" of the human race. As for the possibility of an international class war between the poor states and the wealthy states to break out, our analysis indicates that on the basis of the concept of relative deprivation (Stark 1991) of microeconomics, contrary to what Huntington (1996, p. 33) believed that such a world war "between the poor south and the wealthy north is almost as far from reality as one happy and harmonious world," this class war is very likely to occur between the rich nations and those that are not really poor but feel strongly and convincingly that they have been relatively deprived of their rights and prosperity.

In terms of chaos experienced by individual civilizations, among others, we provide a systemic analysis on why the European states have trouble to become a greater nation by combining some of themselves, why mobile people make their societies more powerful, and what the natural causes are for the rise and fall of the West in the past 500 years. Our analysis answers no to the possibility that Europe's past will become the future of Asia, as suggested by Friedberg (1993/1994, p. 7). This analysis also explains why throughout history Chinese international policies have been more about influencing others than conquering as what the West did in the recent history. What is very interesting is that we show that those multiculturalists in the United States are in fact helping to make America a new civilization, developed on the strengths of other civilizations naturally brought over by migrants.

To address the problem of what brings prosperity to a specific geographic region, the Third and Fourth Laws on State of Motion are applied. One necessary

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condition is found that only when a civilization's yoyo structure contains a convergent spinning field, the civilization has the potential to bring about prosperity. As for the story of the West, the Fourth Law spells out the theoretical conclusion that it is an offspring of some lending civilizations, each of which contains a divergent spinning field, while the newborn is convergent. Hence, riding on the strengths of all the surrounding, divergent civilizations, the independent area, existing between these civilizations, that is blessed with rich natural resources experience cultural and economic prosperity.

As for what makes a society instrumental or consummatory, it is shown that cultures, located in natural environments that resemble more the setup of Fultz's dishpan experiment with a "solid periphery" and an uneven distribution of necessary natural resources, tend to be consummatory, while those cultures situated naturally in open lands surrounded by large bodies of water with relatively even distributions of natural resources are more likely to be instrumental.

Based on the discussions in Chaps. 5, 6 and this chapter, we clearly point to the natural reasons behind the 1990s' collapse of the bipolar balance of power of the Cold World and explain why after one superpower disappears, the world falls into an identity crisis by addressing the question: who are we? Even the United States, the surviving superpower, has to face the same crisis.

This chapter is organized as follows. Section 7.1 studies the potential peace and harmony that seem to appear after major conflicts in the twentieth century. Section 7.2 focuses on the study of internal turmoil within civilizations. Section 7.3 looks at the fascinating problem of how economic prosperities travel from one region to another. Section 7.4 investigates the relationship between Westernization and modernization. Once again, the reader is advised that most of the historical facts regarding civilizations cited in this part of the book come from Huntington (1996) and the references found there. Due to the nature of the problems considered, we will apply the assumptions of continuity and differentiability as needed in order to take advantage of all the mathematical tools available to us.

7.1 Peace and Harmony?

After major conflicts, an illusion of harmony tends to flourish. For example, World War I was seen (Roosevelt 1945, p. 586) to end all wars so that the world would be safe for democracy; and World War II would end the system of unilateral action, the exclusive alliances, the balances of power, and all other expedients that have been tried for centuries and have always failed; instead, the world would have a universal organization of peace-loving nations and the beginnings of a permanent structure of peace. However, World War I generated communism, fascism, and the reversal of a century-old trend toward democracy. And, World War II produced a cold war that was truly global. The illusion of harmony and peace at the end of the Cold War was soon dissipated by the multiplication of ethnic conflicts and ethnic

cleansing, the breakdown of law and order, the emergence of new alliance and conflict among states, the resurgence of neo-communist and neo-fascist movements, intensification of religious fundamentalism, and the inability of the United Nations and the United States to suppress bloody local conflicts. In the five years after the Berlin wall came down, the word "genocide" was heard way more often than in any five years during the Cold War.

Question 7.1 Is the "illusion" of peace and harmony felt after major conflicts in the twentieth century a physical reality or indeed an illusion?

When we model the world of all peoples as one single eddy current of "fluids," as what has been done throughout (Lin and Forrest, to appear a, d, and e), then each major conflict, such as the WW I, WW II, and especially the Cold War, can be identified with one of the transitional changes (blown-ups) existing between converging and diverging motions of the current. Hence, both Hide's and Fultz's dishpan experiments indicate that the "illusion" of peace and harmony felt right after major conflicts in the twentieth century is indeed a subjective sense of the physical reality that the chaotic flows of "liquids" started to move quasi-uniformly around the polar center. However, soon after the short-lived reality of quasi-uniformity appears, the "asymmetries" of the environment and "impurities" existing along with "fluids" begin to weigh into the play and make the "fluid's" quasi-uniform motion experience subeddy movements at various locations. And, before long, some of these local subeddies are strengthened to such degrees that they begin to create confrontational interactions.

While expectations of one world of peace and harmony appear at the end of major conflicts, the tendency to think in terms of multiple (at least two) worlds exists throughout human history. For example, people always tend to divide the world population as "us" and "others," the insiders and the outsiders, and our great civilization and those barbarians. To a large degree, major civilizations in history have been closely identified with the world's great religions; and people who share ethnicity and language but differ in religion may slaughter each other, as what had happened in Lebanon, the former Yugoslavia, and the Subcontinent (Tiryakian 1974). So, as long as there are different regions the world will be multiple cultured. And, with the definition of wars generalized, we have seen trade wars between rich states and bloody and more traditional wars between poor nations.

Question 7.2 Considering the current economic landscape around the globe, is it possible for an international class war between the poor states and the wealthy states to break out?

According to Huntington (1996, p. 33), such a world war "between the poor south and the wealthy north is almost as far from reality as one happy and harmonious world." However, based on a close scrutiny of the international economics, the research conclusions obtained on the concept of relative deprivation in economics (Lin and Valencia 2008; Stark 1991) well indicate that such a class war is more likely to occur than we expect, because it is not exactly those states that are

poor that they might start such a class war. Instead, those states that are not really in poverty but feel strongly and convincingly that they have been relatively deprived of their rights and prosperity would more likely engage in actions in order for them to claim their perceived rights and prosperity. This end makes perfect sense by using our yoyo model, because only those spin fields that are strengthening in their power and vigor would have the motivation and capability to suck in more resources from all other potential civilizations and spit out more products and cultural assertiveness and influence on others. For example, population pressure (an indicator of the huge mass of the civilizational body) and economic stagnation (a sign of relative deprivation when compared to those who live in prosperity) promote Muslim migration to other non-Muslim societies. In the 1970s, the demographic balance in the former Soviet Union shifted drastically with Muslims increased by 24% while Russians increased by only 6.5%, causing great concern among Central Asian communist leaders (Dragounski 1995). Spain experiences a population growth of less than one-fifth of 1% a year and is uneasy confronted by Maghreb neighbors with populations growing more than ten times as fast and per capita GNPs about one-tenth of its own (Huntington 1996, p. 120).

7.2 Chaos Experienced by a Civilization

Due to difficulties in communication and transportation, for the most part of human existence, contacts between civilizations were intermittent or nonexistent. During the era of Warring States, which covers the period from some time in the fifth century BC to the unification of China by the Qin Dynasty in 221 BC, regional warlords annexed smaller states around them and consolidated their rule. By the third century BC, seven major states, named Qi, Chu, Yan, Han, Zhao, Wei, and Qin, had risen to prominence. This time period saw the proliferation of iron working, replacing bronze. Land areas, such as Shu (modern Sichuan) and Yue (modern Zhejiang), were brought into the Chinese cultural sphere during this time. Different philosophies developed into the Hundred Schools of Thought, including Confucianism, Taoism and to a lesser extent Zhuang Zi. Trade became important, and some merchants had considerable power in politics. The military made combined use of infantry and cavalry. From this period on, the nobles in China remained a literate rather than a warrior class, as the kingdoms competed against each other. This was the time the legendary military strategist Sun Tzu (Sun Zi) wrote *The Art of War*, which is recognized today as the most influential and oldest known military strategy book.

In the past 400 plus years of the recent history, the nation states of the West, Britain, France, Spain, Austria, Prussia, Germany, the United States, and others constituted a multi-polar international system within the Western civilization. They competed with each other, expanded, colonized, and influenced every other civilization. In addition to interacting in a domination–subordination fashion with non-Western societies, the Western states interacted on a more equal basis with

each other, closely resembling those that had occurred in Chinese, Indian, and Greek civilizations. They were based on a cultural homogeneity in terms of language, law, religion, administrative practice, agriculture, land holding, and perhaps kinship as well. Europeans shared a common culture, maintained an extensive and active network of trade, a constant movement of persons, and a tremendous interlocking of ruling families (Tilly 1975, p. 18). For much of this period, the Ottoman Empire controlled up to one-fourth of Europe. However, the empire was not considered a member of the European national system by the Europeans.

History has shown that differences in wealth may lead to conflicts between societies, when rich and more powerful societies attempt to conquer and colonize poor societies. The ancient Chinese did this many times in history, say, for over 700 years during the era of warring states, and the West did this for 400 years in the recent past. In the later case, some of the colonies rebelled and waged wars of liberation against the colonial powers. In the current world, decolonization has occurred, and colonial wars of liberation have been replaced by conflicts among the liberated people.

Question 7.3 Within the control of an empire, what causes the internal turmoil, such as the case in the era of Warring States in ancient China and the case of decolonization of the Western world?

Now, with our yoyo model established and well employed to address many important problems of international politics in the study of civilizations (Lin and Forrest, to appear a, d, and e), the answer to this question seems to be quite natural and straightforward. From the dishpan experiment, if the control of an empire was seen as a spinning field, then due to uneven distribution of gradient forces existing within the structure of the empire, periodical internal turmoil would naturally occur throughout the evolution of the empire. When a specific internal turmoil becomes an overwhelming problem and a challenge to the empire while exhausting either the human or the financial or both of these resources, the empire will experience a contraction until the exhaustion and depletion of the resources is stopped or is under control. Otherwise, the empire, no matter how powerful it has been, would eventually fall and become history.

For over 150 years before the Treaty of Westphalia, the Western sphere was dominated by religious schism and by religious and dynamic wars. And, after the Treaty, the conflicts within the Western world were largely among princes, absolute monarchs, and constitutional monarchs attempting to expand their bureaucracies, their military powers, their mercantilist economic strength, and the territory they control. Similar to the situation during the era of Warring States in ancient China, in the process of power struggle, nation states were created. Then, starting with the French Revolution, the principal lines of conflicts were between nations rather than princes (Palmer 1986, p. 119). In 1917, consequent to the Russian Revolution, the conflict of nation states was supplemented by that of ideologies. In the Cold War, the ideologies of communism and liberal democracy were respectively embodied in the two superpowers, neither of which was a nation state.

Question 7.4 On the surface, the internal conflicts in Europe for over 300 years were subsided by an external unity and rise, the Russian Revolution in this case; is there any natural reason behind the change?

Since each of the European nations within the Western civilization, as discussed in Lin and Forrest (to appear), stands for a convergent yoyo structure, all of which are located in a quite homogeneous natural environment with relatively even distribution of natural resources, the totality of these individual yoyos can be seen as a pool of such spin fields as those described in Fig. 7.1b. These eddies are convergent, spin in the same direction, and exist side by side. Because each of these eddies is self-sustained in terms of natural resources and does not rely on others to survive, they do not have the need to combine into a greater nation state. The situation is similar to that of the existence of binary star, tri-nary star, and n-nary star systems (Lin 2007), where n is a natural number. In particular, Newton's law of universal gravitation

$$F_{\text{grav}} = G\frac{m_1 m_2}{r^2}, \tag{7.1}$$

where G is the universal gravitation constant, m_i the mass of the ith celestial body, $i = 1, 2$, and r the distance between the bodies, indicates that when $r \to 0$, the gravitational pull F_{grav} between the masses m_1 and m_2 should be approximately ∞. Thus, no masses in the universe would be able to fight against such an infinitely large force of attraction. However, in a binary star system, for example, the two stars travel around their common center of mass in their individual elliptical orbits without simply being pulled together to form one bigger celestial body. For the situation of the European cultures, because their spin fields, when seen as yoyo structures, are convergent and spin in the same direction, they do have the tendency to combine and become one greater eddy pool (or greater nation state). However, although there is such a tendency, internal to the said land, they still will not become one spin field. To this end, let us look at the situation with only two spin fields M and N as depicted in Fig. 7.1b. The other sides of these two yoyo fields look like that in Fig. 7.1a. The fields in Fig. 7.1b attract each other and have the tendency to combine into one spin field. However, when they are too close to each other, the diverging fields of M and N, as shown in Fig. 7.1a, start to repel against each other (Fig. 7.2). The force of repellence comes from the opposite and divergent spinning directions of the fields of N and M. Under the influence of this force, N is pushed away along the (i) direction and M along the (ii) direction (Fig. 7.2). When N and M travel away from each other to a certain distance, the attractions of the other sides of N and M (Fig. 7.1b) start to once again pull them together. Such alternating effects of repellence and attraction keep the cultures N and M together as a binary culture system while fastening the cultures on their individual paths of development. For such an analysis to work in practice, the cultures involved have to be quasi-equal (analogous to the concept of equal-quantitative effects) so that none of them can simply break and destroy the other and absorb the debris of the destroyed culture.

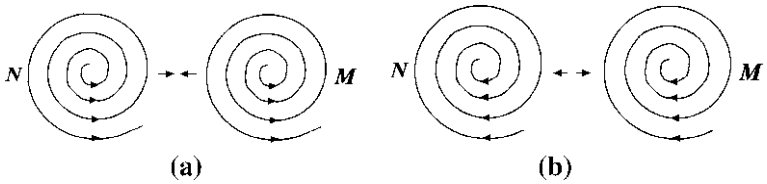

Fig. 7.1 Attracting and repelling two-civilization system. **a** Both *N* and *M* diverges. **b** Both *N* and *M* converge

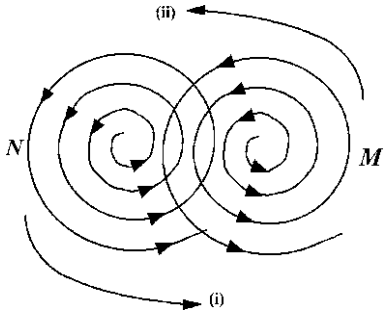

Fig. 7.2 Spin fields of *N* and *M* repel against each other

Now, for Question 7.4, the external pressure temporarily changes the internal dynamics between the European nation states so that these European states have enjoyed a prolonged period of peace and prosperity. As soon as the external pressure is removed, assuming that there no other external threat appears, the European situation might very well go back to that of its recent past.

In the 1960s, in most of the world, less than one-third of the adult population was literate. In the 1990s, in very few countries apart from Africa less than one-half of the population was literate. About 50% in India and 75% in China could read and write. By the early 1990s, in every region except Africa, virtually the entire age group was enrolled in primary education. In terms of secondary education, in the early 1960s in Asia, Latin America, the Middle East, and Africa, less than one-third of the appropriate age group was enrolled in school programs. By the early 1990s, one-half of the age group was enrolled except in Africa.

In 1960, urban residents made up less than one-quarter of the population of the less developed world. Between 1960 and 1992, the urban percentage of the population rose by more than 49–73% in Latin America, 43–55% in Arab countries, 14–29% in Africa, 18–27% in China, and 19–26% in India (UN 1994, pp. 136–137, 207–211; World Bank 1984–1994; Russett et al. 1994, pp. 222–226).

These progresses made in areas of education and urbanization created socially mobile populations with enhanced capabilities and higher expectations, which can be activated for political purposes. That is why Huntington (1996, p. 86) concludes that socially mobilized societies are more powerful societies. For example, in 1953, when less than 12% of Iranians were literate and less than 17% urban,

Kermit Roosevelt and a few CIA operatives easily suppressed an insurgency and restored the Shah to his throne. In 1979, when 50% of Iranians were literate and 47% lived in cities, no amount of US military could have kept the Shah on his throne.

Question 7.5 What makes the levels of literacy and urbanization of a people increase? Why do mobile people make their societies more powerful?

The natural tendency of strengthening its spinning power of the underlying cultural yoyo structure pushes for more elevated levels of literacy of its citizens, an indicator of the ability to absorb more information (a new kind of resource of strength of our modern time), while the degree of urbanization signals how strong a cultural yoyo field spins. Together, it explains why mobile people make their societies more powerful, since the liquidity of materials in a spin field represents the degree of uniformity of the eddy motion in the cultural spin field. Our earlier analysis has shown that the more uniform the spin field is, the more vigor and strength the yoyo structure possesses without suffering from internal exhaustion.

With the conclusion of the Cold War, the dissolution of the Soviet system was dramatic, while the "free world" is also although slowly but similarly reconfigured, quite like what the Japanese philosopher Takeshi Umehara (1992) has suggested, "The total failure of Marxism….and the dramatic breakup of the Soviet Union, are only the precursors to the collapse of the Western liberalism, the main current of modernity. Far from being the alternative to Marxism and the reigning ideology at the end of history, liberalism will be the next domino to fall." With the establishment of the European Union, consisting of France and Germany as the core, and other member states, such as Belgium, Britain, Denmark, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, etc., the successor to the tsarist and communist empires is a civilizational bloc, paralleling in many respects that of the West in Europe. Russia is at the core, and closely linked to an inner circle, including the two predominantly Slavic Orthodox republics of Belarus and Moldova, Kazakhstan, and Armenia. In the Orthodox Balkans, Russia has close relations with Bulgaria, Greece, Serbia, and Cyprus, and somewhat less close ones with Romania. The Muslim republics of the former Soviet Union remain highly dependent on Russia, both economically and in the security area (Huntington 1996, p. 163).

Question 7.6 From the afore-described reconfiguration of political and economic alliances, and from the changes in the land size and population size under the control of the West from the time when the West began to rise about 500 years ago to the peak reached in the 1920s when it consisted of over 84% of the earth's land surface and over 400 million people, to the current scales which are equivalent to the original of over 500 years ago, other than industrial revolution and modernization, for such a worldwide rise and decline are there natural causes, which are also responsible for the industrial revolution and modernization?

As to what is discussed earlier, the answer to this question is YES, there are natural causes in such a worldwide rise and decline of any civilization. The main

cause among others is the decrease in the temperature difference between the equator and the Polar areas. That is exactly the same as what is shown in the experiment of spinning fluids. As for industrial revolution and modernization, both historically and experimentally (dishpan experiment) it has shown that for a local eddy to form and to grow into a regional power and further into an international power, it must possess something new and better than what has already existed. Hence, industrial revolution and modernization are simply natural products created in the process of whole evolution of civilizations.

After Europe served as the principal arena of great power, conflict, and cooperation for seven centuries, the post-Cold War international politics was played out in Asia, and particularly East Asia. Asia is a cauldron of civilizations. For example, East Asia alone contains societies of the following six civilizations: Sinic, Japanese, Orthodox, Buddhist, Muslim, and Western. And south Asia additionally includes Hinduism. The core states of four different civilizations, China, Japan, Russia, and the United States, are major actors in East Asia. South Asia adds India, and Indonesia is a rising Muslim power.

Question 7.7 After centuries of strife, Western Europe is currently peaceful and war is unthinkable. In comparison, considering Asia's current economic dynamism, territory disputes, resurrected rivalries, and political uncertainties, will Europe's past become the future of Asia, as suggested by Friedberg (1993/94, p. 7)?

Based on our yoyo model analysis, the answer to this question is NO; Europe's past will not become the future of Asia. The main reason is that due to the natural balance in resources necessary for human survival, Europe is made up of independent nation states that have played the political game of balancing power in the past and will continue to do so in the foreseeable future. This is because the European states are quite even in strength if seen as spin fields. On the other hand, the landscape of East Asia has produced many yoyo structures of different sizes, which is evidenced by the good number of different civilizations in Asia, with China sitting right in the biggest "dishpan with a solid periphery" of the world. This end explains why throughout history Chinese international policies have been more about influencing others than conquering as what the West did in the recent history. This is because as soon as the yoyo that exists in the land of China starts to pick up its spinning strength, all the surrounding small yoyos will be naturally sucked inwardly toward it. As for whether or not the current economic dynamism, territory disputes, resurrected rivalries, and political uncertainties will create civilizational conflicts in Asia, the answer drawn on our analysis is NO. This is because as long as the natural yoyo, which sits right in China, picks up its vigor and strength in a timely fashion, all other smaller civilizations in the region will experience irresistible attraction from this biggest spin field of the world and in history so that instead of fighting against such irresistible pull, the Asian societies will learn from each other to see how they can all benefit from the natural spinning structure they are in.

Faced with shortage of skilled labor, the western countries depend on immigration to provide them with new vigor and human capital by attracting able, talented, and energetic people from other civilizations. However, in the process for

the new migrants to be assimilated into the cultures of the host countries, the problems of moral declining, cultural suicide, and potential disunity that the West suffers from, continuously worsen. Also, for the West, an immediate challenge exists in the United States, as the leader of the Western civilization. For example, American national identity has been culturally defined by the heritage of the Western civilization. However, starting in the late twentieth century, components of American identity have been under onslaught by an influential number of intellectuals and publicists in the name of multiculturalism. These multiculturalists seek for infusions of different cultures (Schlesinger 1992, pp. 66–67, 123). To this end, Theodore Roosevelt warned (Schlesinger 1992, p. 118), "The one absolutely certain way of bringing this nation to ruin, of preventing all possibility of its continuing as a nation at all, would be to permit it to become a tangle of squabbling nationalities."

Question 7.8 Some leaders over the course of history have at various times attempted to disavow their cultural heritage and to shift the identity of their countries from one civilization to another. In no case to date have they succeeded and they instead created torn countries and put their peoples through various miseries. From this fact and the appearance and formation of the Western civilization, is it possible that those multiculturalists in the United States might help make America a new civilization, developed on the strengths of other civilizations naturally brought over by migrants?

Our analysis seems to suggest a YES to this question. It is because the rise of the Western civilization is in fact a natural consequence of combining the strengths of several successful civilizations from the past. With immigrants coming from different parts of the world, the United States will surely experience a degree of difficulty in its attempt to naturalize these newcomers so that they would be more smoothly assimilated into the new culture. On the other hand, in their individual struggles for personal success, these new immigrants would naturally absorb what is beneficial to them from the American culture and their consequent, new found successes in general would stimulate those around them in the United States to learn from these new immigrants. These localized circulations of knowledge and learning would naturally bring elements from all the different cultures into American lives, creating a brand new culture or civilization at the grand level. Hence, the cultural change in the United States, which starts and continues voluntarily at the root level, is different from all those of the past where leaders of some countries attempted to disavow their cultural heritage and to shift the identity of their countries from one civilization to another. The failures of the past are mainly a consequence of drastic changes from the top without much support from the grassroot levels. As the Western influence on the world dwindles with time, it is actually a good opportunity for the United States to emerge as a new civilization, constructed on the goodness of the Western civilization, with its own identity that contains elements from different cultures. Thus, in the future arena of international politics, the United States could handily form alliances and coalitions with people from whichever civilization, since the United States would know all

peoples well and share certain values and philosophical assumptions with each and every people from across the world.

Question 7.9 With civilizations more localized after the Cold War, will it be natural for the United States of America to continue its close association with the European states across the Atlantic Ocean?

Our analysis above indicates that the answer to this question is YES, because as the multiculturalism flourishes and succeeds in America, the United States will be positioned more conveniently than ever before to associate itself with any people from across the world in dealing with pressing and urgent international matters. On the other hand, as the United States is multi-culturalized, the Western civilization at the same time will evolve into a new page in history, instead of making "the West become a minuscule and declining part of the World's population on a small and inconsequential peninsula at the extremity of the Eurasia land mass," as worried Huntington (1996, p. 307). Considering the strengthening revivals of other civilizations, it is indeed a right time in history for the United States to shape its own cultural identity with its unique national and civilizational characteristics. With its specific ethnic and religious mix, the United States can communicate effectively with any of the core states of other civilizations while greatly reducing antagonism of others toward itself. For example, while Europeans universally acknowledge the fundamental significance of the dividing line between Western Christendom on the one hand, and Orthodoxy and Islam on the other, the United States is not recognizing any fundamental division among the Catholic, Orthodox, and Islamic parts of Europe so that the United States is in a better position to communicate and to collaborate with any of these parts of Europe. Thus, at the same time when multiculturalism in America threatens the old West, it helps to develop the West into a new and more encompassing civilization, if the Europeans also want to do so, and better positions the United States in handling current and future international affairs.

Like what is correctly stated in Huntington (1996, pp. 310–312), "as a mature society, the old West no longer has the economic or demographic dynamism required to impose its will on other peoples … it is in the interest of the United States … to recognize that (its) intervention in the affairs of other civilizations is probably the single most dangerous source of instability and potential global conflict in a multicivilizational world." Constant interventions in other peoples' affairs will surely weaken the United States politically, economically, and militarily, while creating a more united front around the world against the United States.

7.3 How Economic Prosperities Travel?

During the eighth and the nineth centuries, European Christendom started to emerge as a distinct civilization and lagged behind many other civilizations, such as China (respectively in Tang, Song, and Ming dynasties), the Islamic world, and

the Byzantium, in its level of civilization and in the following several hundred years in terms of wealth, territory, military power, and artistic, literary, and scientific achievements (Toynbee vol. VIII, p. 347–348). During the eleventh and thirteenth centuries, European culture began to develop by absorbing suitable elements from the higher civilizations of Islam and Byzantium together with adapting the inheritance to the special conditions and interests of the West. During the same time period, Western Christianity successfully converted Hungary, Poland, Scandinavia, and the Baltic coast; and Roman law and other aspects of Western civilization were established soon after that time period. During the twelth and thirteenth centuries, Westerners struggled to expand their control of Spain and did establish effective dominance of the Mediterranean; however, the rise of Turkish power brought about the collapse of Western Europe's first overseas empire (McNeill 1992, p. 547). By the 1500s, the renaissance of European culture was well underway and social pluralism, expanding commerce, and technological achievements provided the basis for a new era in global politics. Multidirectional encounters among civilizations gave way to the sustained impact of the West on all other civilizations in the following hundred years, during which it generated a significant political ideology without generating a major religion.

Question 7.10 What brings prosperity, such as the renaissance of European culture, to a specific geographic region?

Based on the First Law on State of Motion, any newly found prosperity of a civilization has to come from interactions with other civilizations. Internal appearances of eddy leaves, as seen in dishpan experiment (Hide 1953; Fultz et al. 1959; Lin, to appear A), only mean that periodically local prosperities could be expected within the civilization. To address this question successfully, let us look at the following:

The Third Law on State of Motion (Lin 2007): When two yoyos N and M act on each other, their interaction falls in one of the six scenarios as shown in Figs. 7.3a–c and 7.4a–c. And, the following are true:

(1) For the cases in (a) of Figs. 7.3 and 7.4, if both *N* and *M* are relatively stable temporarily, then their action and reaction are roughly equal but in opposite directions during the temporary stability. In terms of the whole evolution involved, the divergent spin field(*N*) exerts more action on the convergent field (*M*) than *M*'s reaction peacefully in the case of Fig. 7.3a and violently in the case of Fig. 7.4a.
(2) For the cases (b) in Figs. 7.3 and 7.4, there are permanent equal, but opposite, actions and reactions with the interaction more violent in the case of Fig. 7.3b than in the case of Fig. 7.4b.
(3) For the cases in (c) of Figs. 7.3 and 7.4, there is a permanent mutual attraction. However, for the former case, the violent attraction may pull the two spin fields together and have the tendency to become one spin field. For the latter case, the peaceful attraction is balanced off by their opposite spinning directions. And, the spin fields will coexist permanently.

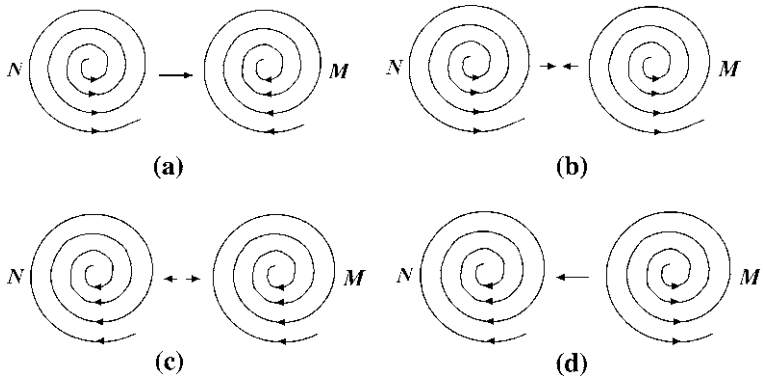

Fig. 7.3 Same scale acting and reacting spinning yoyos of the harmonic pattern. **a** *N* diverges and *M* converges. **b** Both *N* and *M* diverge. **c** Both *N* and *M* converge. **d** *N* converges and *M* diverges

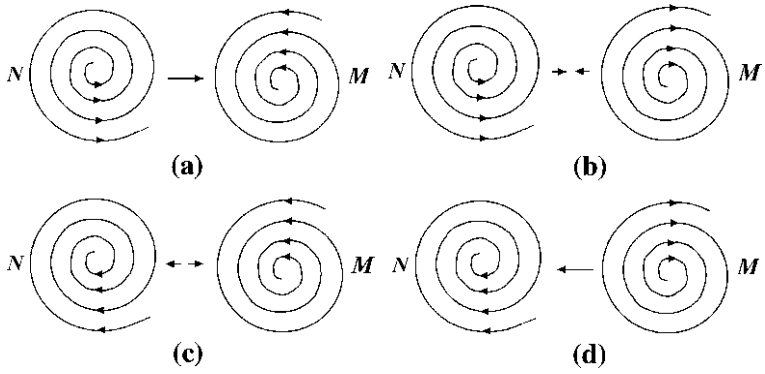

Fig. 7.4 Same scale acting and reacting spinning yoyos of inharmonic patterns. **a** *N* diverges and *M* converges. **b** Both *N* and *M* diverge. **c** Both *N* and *M* converge. **d** *N* converges and *M* diverges

In all the scenarios discussed in the Third Law on State of Motion, only when a civilization's yoyo structure contains a convergent spinning field, the civilization has the potential to bring about prosperity, because each divergent field constantly loses its assets. In comparison, the convergent civilization *M* in Fig. 7.3a has a better chance than the civilization *M* in Fig. 7.4a to obtain wealth, because due to opposite spinning directions the spinning yoyo *M* in Fig. 7.4a receives assets from *N* with delay and struggle, while the harmonic spinning pattern in Fig. 7.3a makes transfers from *N* to *M* very easy. The convergent *N* in Fig. 7.4b is in a similar situation as the convergent *M* in Fig. 7.3a. For the scenario in Fig. 7.4c, both civilizations *N* and *M* can be prosperous at the same time. However, due to their opposite spinning directions, they will not be on friendly terms in dealing with

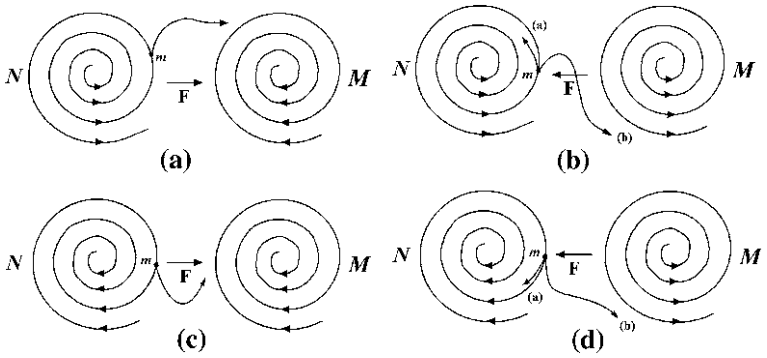

Fig. 7.5 Acting and reacting models with yoyo structures of harmonic spinning patterns. **a** Object *m* is located in a diverging eddy and pulled by a converging eddy *M*. **b** Object *m* is located in a diverging eddy and pulled by a diverging eddy *M*. **c** Object *m* is located in a converging eddy and pulled by a converging eddy *M*. **d** Object *m* is located in a converging eddy and pulled by a diverging eddy *M*

global affairs for at least 50% of the time. What is interesting is the scenario in Fig. 7.3c, where both of the convergent civilizations *N* and *M* have the tendency to combine into a much greater spinning yoyo structure. To this end, one natural problem of practical significance is that when faced with an objective social organization, how can we tell whether it is convergent or divergent? There are many ways to accomplish this end. For example, if one organization has a rigorous mechanism in place to prevent its members and/or properties from leaving, then the underlying yoyo structure of the organization is divergent. If one organization has a tighter control than another organization, then the former organization is more divergent than the latter.

Now, the story of the West is different from all the scenarios discussed in the previous paragraph, because in history the Western civilization is a new species when compared to other age-old civilizations. To this end, let us look at the following:

The Fourth Law on State of Motion (Lin 2007): When the spin field *M* acts on an object *m*, rotating in the spin field *N*, the object *m* experiences equal, but opposite, action and reaction, if it is either thrown out of the spin field *N* and not accepted by that of *M* (Figs. 7.5a, d, 7.6b, c) or trapped in a subeddy motion created jointly by the spin fields of N and M (Figs. 7.5b, c, 7.6a, d). In all other possibilities, the object m does not experience equal and opposite action and reaction from *N* and *M*.

Since the Western civilization is not closely attached to any other civilization other than receiving beneficial elements from others, it means that it is an offspring of these lending civilizations, each of which contains a divergent spinning field (Fig. 7.7), while the newborn is convergent. So, the answer to our question is that riding on the strengths of all the surrounding, divergent civilizations, the independent area, existing between these civilizations, that is blessed with rich natural

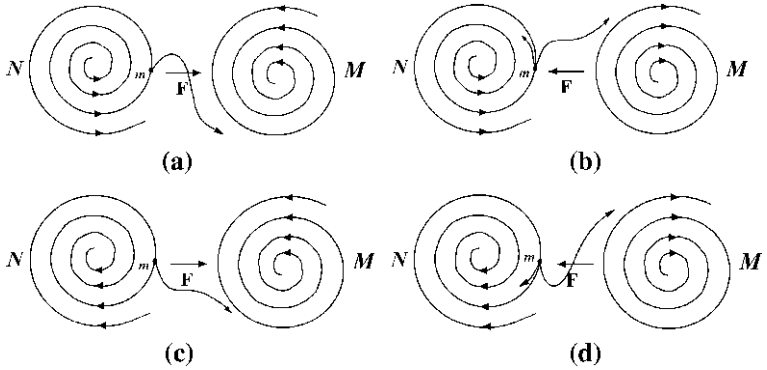

Fig. 7.6 Acting and reacting models with yoyo structures of inharmonic spinning patterns. **a** Object *m* is located in a diverging eddy and pulled by a converging eddy *M*. **b** Object *m* is located in a diverging eddy and pulled by a diverging eddy *M*. **c** Object *m* is located in a converging eddy and pulled by a converging eddy *M*. **d** Object *m* is located in a converging eddy and pulled by a diverging eddy *M*

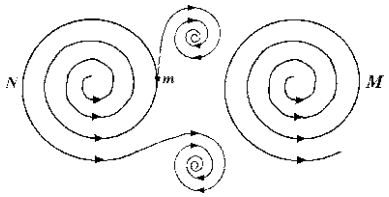

Fig. 7.7 Object *m* might be thrown into a subeddy created by the spin fields of *N* and *M* jointly

resources, will experience cultural and economic prosperity. It will be more so, if the surrounding civilizations at the same time suffer from internal chaos (as during the time period of having eddy leaves in the dishpan experiment (Hide 1953; Fultz et al. 1959; Lin, to appear A)).

7.4 Relationship Between Westernization and Modernization

Along with the Western expansion, leaders of non-Western societies have responded to the external impact in one or more of three ways: rejecting both modernization and Westernization; embracing both; embracing modernization but rejecting Westernization. From 1542 until the mid-nineteenth century, Japan followed a rejectionist course from its first contacts with the West. In 1854, Commodore Perry made his forcible opening of Japan, which led to Japanese dramatic efforts to learn from the West following the Meiji Restoration in 1868. In terms of China, for centuries, it attempted to bar any significant modernization or Westernization. Chinese rejectionism was brought to an end by the British in the Opium

War of 1839–1842. In roughly 1918, Mustafa Kemal Ataturk of Turkey realized that modernization was desirable and necessary, that the indigenous culture was incompatible with modernization and had to be abandoned, and that the society had to be fully Westernized in order to successfully modernize. In his opinion, modernization and Westernization would reinforce each other and have to go hand in hand together. He established a new Turkey out of the ruins of the Ottoman Empire and launched a massive effort both to Westernize and to modernize his new country. In this course of rejecting the Islamic past, Ataturk made Turkey a torn country that was Muslim in its religion, heritage, customs, and institutions with a ruling elite who determined to make it something different. In the 1830s, Muhammad Ali of Egypt attempted technical modernization without cultural Westernization. His effort failed when the British forced him to abandon most of his modernization reforms. Thus, Egypt's destiny was neither like the Japanese fate of technical modernization without cultural Westernization nor an Ataturk fate of technical modernization through cultural Westernization (Mazrui 1990, pp. 4–5).

The recent history of the past several hundred years has revealed such a general pattern of modernization and Westernization: Initially, Westernization and modernization are closely linked with a non-Western society absorbing elements of Western culture while making slow progress toward modernization. As the modernization brings forward economic benefits, the process of Westernization starts to reverse with the indigenous culture being revived. Further modernization weakens the influence of the West and strengthens the commitment of the non-Western society to its indigenous culture in two ways. At the societal level, the economic benefits of modernization enhance the military and political power of the society so that the people of that society gain confidence in their culture and become culturally assertive. At the individual level, modernization destroys traditional bonds and social relations leading to crises of identity. Because of the crises, people turn to religion. That is, recipient civilizations selectively borrow items from other civilizations and adapt, transform, and assimilate them so as to strengthen and ensure the survival of the core values of their own cultures (Bozeman 1975, 5ff; Spengler 1926, 1928). All the contemporary civilizations have a demonstrated record of borrowing from other civilizations in ways to enhance their own survival. China's absorption of Buddhism had served Chinese purposes and needs, while Chinese culture remained Chinese. Muslim Arabs made use of their Hellenic inheritance for essentially utilitarian reasons; being interested in only borrowing certain external forms or technical aspects, they knew how to disregard all those elements from the Greek thoughts that would conflict with the truth as established in their fundamental Koranic norms and precepts (Bozeman 1975, p. 7). In the seventh century, Japanese introduced Chinese culture into their lives and made their transformation on its own initiative to high civilization. During the centuries that followed, periods of relative isolation from continental influences, during which previous borrowings were sorted out and the useful ones assimilated would alternate with periods of renewed contact and cultural borrowing. Through all these phases, Japanese culture remained its distinctive character (Naff 1985/1986).

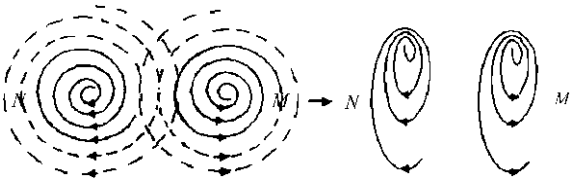

Fig. 7.8 Imaginary action and reaction spin fields of our solar system *M* and a neighboring system *N*

Question 7.11 Why would an existing civilization feel the need to borrow elements from other civilizations? Is it simply for its own survival?

Question 7.12 What factors contribute to the isolation of a civilization from the rest of the world, such as in the cases of China and Japan in history?

Question 7.13 (Huntington 1996, p. 77) Are there some non-Western societies in which the obstacles the indigenous culture poses to modernization are so great that the culture must substantially be replaced by Westernization if modernization is to occur?

To address these problems, let us recall that for two-dimensional eddy currents, positive and negative (that is, converging and diverging) rotations are transformed into each other alternately by going through transitional changes (blow-ups). For details, see the discussions of Eq. 5.3.

Now, in a world that is filled with many co-existing civilizational, spinning yoyo fields, the rise and fall of a civilization are simply parts of the natural cycle of the civilization's evolution with the time periods of transitional changes (blown-ups) as the weakest links of the whole evolution of each civilization, as indicated by the Theorem of Never-Perfect Value Systems (Theorem 5.4.1; Lin and Forrest 2008b).

Interactions between civilizations exist universally (since the spinning fields of the yoyo structures extend infinitely into space) so that elements of one civilization are constantly imposed on other civilizations and each civilization relentlessly experiences novel ideas from other civilizations that are not provable within their own systems of values and philosophical assumptions. In particular, when two civilizations *N* and *M* coexist side by side (Fig. 7.8), their infinitely expanding fields have to interfere with each other so that their action and reaction pressure their would-be circular motions into elliptical motions. Thus, the practical operations of the basic values and fundamental philosophical assumptions of a civilization are greatly affected by those of the other civilization as shown in Fig. 7.9, where we took out one loop from the spin field of *N* in Fig. 7.8 and take a closer look. The downward motion along the loop of *N* on the right-hand side is helped by the spin field of *M* (some novel elements of *M* that are not provable in *N*). At the same time, the upward traveling on the left-hand side of the loop of *N* has to overcome the encountering effects of *M*'s spin field (those *M*'s novel but not provable elements in *N*). So to answer Question 7.11, for the civilization *N*, to make itself evolve smoothly (not necessarily for its ultimate survival), it would

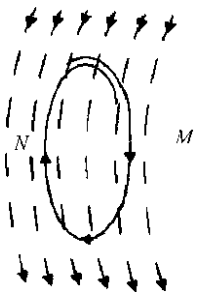

Fig. 7.9 The effect of the spin field of *M* on one loop of *N*

naturally absorb some of those novel elements from other civilizations. The same also holds true for the civilization *M*.

This discussion also helps us to understand why a civilization might isolate itself from other civilizations such as China and Japan in history. For example, if the spin field *N* in Fig. 7.8 stands for a civilization that is naturally separated from all other similar sized civilizations except for some minor connections (controllable from within by *N*) with some of the similar sized civilizations, then to a degree, *N* would become content with how circular its spin field is (this happens only when this civilization is at its peak strength and prosperity), since in this case, the behaviors and the system of values and philosophical assumptions of *N* would not be placed under any pressure from or scrutiny of other civilizations as analyzed above. Combining this conclusion with China's and Japan's natural surroundings, when outside forces, which try to act upon these countries, were relatively weak, the rulers of these and other similar countries would like to cut off the cultural connections from within the countries to the outside world. By doing so, these rulers could potentially strengthen their control of the respective countries. However, as a consequence of doing so, as suggested by the Theorem of Never-Perfect Value Systems, the great and prosperous civilization will soon face its dismay by going through a transitional change (blown-up). That will be when the society has to open up itself to accept useful and beneficial elements from other powerful and prospering civilizations.

As for Question 7.13 about the existence of non-Western societies in which the obstacles the indigenous culture poses to modernization are so great that the culture must substantially be replaced by Westernization if modernization is to occur, our yoyo model analysis above surely points to the possible answer YES. This is because modernization is simply a sequence of actions based on the desire of achieving a certain kind of lifestyle and quality. As we analyzed before, if such desire goes seriously against the fundamental values and philosophical assumptions of a society with a well structured societal hierarchy, then that society would not want to modernize unless the organizational structure is completely rebuilt by external forces. On the other hand, the existence of such societies has to be either under the umbrella of a powerful empire or located in such a remote area that no man of our modern era knows about it; otherwise the sustained existence of such a society would be in doubt. For example, China and Japan in the recent past were

such societies and Amish culture in the United States can be seen as another example.

To address change in Africa, Apter (1960) introduced the concepts of instrumental and consummatory cultures, where a culture is instrumental if it contains a large sector of intermediate ends that are separate from and independent of ultimate ends and a culture is consummatory if it possesses a close relationship between intermediate and ultimate ends. Instrumental cultures can innovate without appearing to alter their social institutions fundamentally, rather innovation is made to serve immemoriality, while consummatory cultures are all part of an elaborately sustained, high-solidarity system in which religion as a cognitive guide is pervasive and has been hostile to innovation. At the same time, internal cultural transformation is generally facilitated by the autonomy of social, cultural, and political institutions (Eisenstadt 1965). That explains why the more instrumental Japanese and Hindu societies (additionally, Singapore, Taiwan, Saudi Arabia, and, to a lesser degree, Iran have become modern societies without becoming Western) move earlier and more easily into modernization than confusion and Islamic societies and that such more instrumental societies are better able to import the modern technology and use it to bolster their existing culture. The current world affairs shows that modernization strengthens those cultures that choose to modernize and reduces the relative power and influence of the West; in fundamental ways, the world is becoming more modern and less Western (Huntington 1996, p. 78).

Question 7.14 What Makes a Society Instrumental or Consummatory?

Based on previous discussions, it can be seen that cultures, located in natural environments that resemble more the setup of Fultz's dishpan experiment with a "solid periphery" and an uneven distribution of necessary natural resources such as fresh water, that have historically accomplished some of the seemingly unthinkable achievements, such as Dujiangyan in Sichuan, China, tend to have well developed, centralized, and powerful bureaucracies. This is because the history of these cultures has repeatedly shown that together or collectively more and greater outcomes can be obtained. Comparing these cultures with those situated naturally in open lands surrounded by large bodies of water with relatively even distributions of vital resources for human survival, the former tends to be consummatory, while the latter could more likely be instrumental, since every individual member's survival in one of former cultures is at stake in almost everything he/she does. For more details, please consult with the discussion of Question 7.2 in Lin and Forrest (to appear B).

In today's post-Cold War world, every state tries to address the question: Who are we? This is because the answer reflects the state's cultural identity, defines its place in world affairs, and pinpoints to its potential friends and enemies. Since the collapse of the Soviet Union in the 1990s, history has witnessed the abrupt appearance of a global identity crisis. The countries suffering from the identity crisis included Algeria, Canada, China, Germany, Great Britain, India, Iran, Japan, Mexico, Morocco, Russia, South Africa, Syria, Tunisia, Turkey, the Unites States, and others.

In coping with the identity crisis of the 1990s, associations are created based on blood, belief, faith, ancestry, religion, language, values, and institutions. Peoples with differences in these areas are separated further from each other. Once again in history, civilizational "we" and external "they" are clearly addressed. As soon as the ideological struggle of the Cold War was over, "we" began to feel more superior than "they," "they" do not have "our" trust, "they" cannot speak "our" civilized language, and "they" do not even have the very same underlying values, motivations, social relationships as "we" have. For instance, Europe's boundaries on the North, West, and South are delimited by substantial bodies of water, which to the South coincides with clear differences in culture; to the east, the boundary starts in the north and runs along what are now the borders between Finland and Russia and the Baltic states (Estonia, Latvia, Lithuania) and Russia, through western Belarus, through Ukraine separating the Uniate west from the Orthodox east, through Romania between Transylvania with its Catholic Hungarian population and the rest of the country, and the former Yugoslavia along the border separating Slovenia and Croatia from the other republics. In the Balkans, this line coincides with the historical division between the Austro-Hungarian and the Ottoman Empire (Huntington 1996, p. 158). This identification of Europe provides clear criteria for the admission of new members to Western organizations.

Along with identity crises, a societal cold war in which Europe could be in the front line between the West and Islam has been increasing its intensity. It is now stretching from the Atlantic in the West to China in the East (Lewis 1990; Sid-Ahmed 1994).

Question 7.15 Were there natural reasons behind the 1990s' collapse of the bipolar balance of power of the Cold World?

Since the collapse of the Soviet Union in the 1990s, there have appeared many different theories as to why that happened. At this juncture, we like to look at the possible natural cause for the end of such an intensive and exhaustive bipolar balance of the world politics. Our reasoning is that we, all humans, are part of nature. Whatever we do or think about doing is a reflection of some fundamental changes occurring in nature, see discussions of blown-up theory in (Wu and Lin 2002). Also, the dishpan experiment suggests that as the temperature difference between the polar circle and the periphery decreases, the number of eddy leaves decreases, too; if the temperature difference disappears, the fluid in the spinning dish flow around the polar circles as a large whirlpool. And, along with an increase in the temperature difference, one can observe eddy currents of two-leaves, three-leaves, four-leaves, five-leaves, six-leaves, etc. Eventually, one can observe fluid currents flowing almost along the meridian lines. So, if we imagine the bipolar balance of power during the Cold War world as the same as the scenario of the two-leaf eddy current in Hide's dishpan experiment, assume that we look at the human race from above the North Pole as Hide, Fultz, and their colleagues did when they conducted their experiments to simulate the airflows over the earth, we can then easily see that the current global warming must be the significant contributing factor that helped to make the international politics (the fluid) around the

world (the dish) flow more evenly. However, what is different from the scenario of the dishpan experiment without any temperature difference between the polar circle and the periphery is that in today's world, there is still a temperature difference between the equator and the polar areas and the surface of the earth is not nearly as smooth and symmetric as the bottom of the dish used in the experiment. That explains why after one superpower disappears, the world falls into an identity crisis by addressing the question: who are we? Even the United States, the surviving superpower, has to face the identity crisis.

Riding on the results of the previous chapters, in this chapter, the newly established figurative method developed on the systemic yoyo model is employed in the study of peace and harmony among civilizations, turmoil within a civilization, how economic prosperities travel, and how Westernization and modernization relate to each other. Other than obtaining several important results in sociology, we surely hope to have shown along with the previous chapters that the same methodology, named the systemic yoyo model, can be equally applied to studies of natural and social sciences, and practical applications, such as disastrous weather forecasting (Lin 2008b). As a matter of fact, Lin (2008b) provides plenty of evidence to show that this systemic model is well suited to play the role of a playground for investigations of systems science, just as the role played by the Cartesian product system in studies on natural science.

What is studied in this part of the book are some theoretical results that are not obtainable using conventional methods of statistics, because for the purpose of making valid statistical inferences, the history just did not provide us with enough data. Besides, whenever statistical methods are used, the resultant inferences are always associated with probabilities, which "scientifically" makes the inferences correct forever no matter what the true situations are. For example, in the USA, we commonly listen to such weather forecasts as, the chance of scattered rains for tomorrow afternoon is 70%. Now, no matter what happens during the said afternoon, whether a scattered rain occurs or not, this forecast is scientifically correct, because it only says that the chance of rain is 70%. The same scientific correctness of the forecast still holds true, even if the given probability 70% is replaced to be the probability of 100%, because that number, no matter what value it takes, only stands for chance instead of any guarantee. For those readers who are interested in studying more details along this line, please consult with OuYang and Lin (2006). Thus, any attempt of using large-scale empirical data to "verify" the results of this part at the level of civilizations will prove to be fruitless and misleading. This is the reason why we expect that this work and its theoretical results, derived on the laws on state of motion of materials, which are rigorously shown by respectively using calculus-based on methods, vector analysis, and geometry of curvature spaces (Lin, to appear A), will be truly useful for policy-makers at the national and international levels.

It is our expectation that the conclusions in this part of the book should be able to attract the attention of the scientific community, because we have shown how similar analysis employed in natural science can be equally applied to studies on social science.

Part III
Systemic Structure Beneath Business Organizations

Chapter 8
Economic Entities Seen as Spinning Systemic Yoyos

As suggested by the title, in this part of the book, we will focus on how the systemic yoyo model (Fig. 4.1) and its relevant figurative analysis method (Chap. 4) can be not only applied to the study of the laws of motion, astronomy, and the three-body problem (Lin 2008b, Chaps. 4–6), where Newton's laws have been historically considered as one of the main reasons why physics is an "exact" science, but also equally applicable to such inexact studies as economics, evolutions of business, and management, which are parts of social sciences. Situations studied in these areas of social sciences are fundamentally different of those considered in natural sciences, because humans are involved in each economic and management situation and their desires always alter the evolution of the outcome, leading to unpredictable, chaotic consequences (Soros 1998). What is presented in this part of the book shows that when each business entity is seen as a rotating yoyo with a spin field around it, this fundamental difference seems to disappear and the seemingly unpredictable, chaotic consequences of human organizational desires and corresponding behaviors no longer look unpredictable and chaotic.

What is new in this part of the book from the mainstream literature in economics, organizational behaviors, and management science is that we learn how various problems considered in these areas can be seen as problems of (general) systems and spinning yoyos in the light of whole evolution of these systems, for the concept of general systems and related studies, please consult with (Lin 1999). In particular, in this chapter, we first see that in a market of free competition, the concept of demand and supply is in fact about how different economic forces mutually restrict each other and mutually react on each other. Therefore, when calculus-based mathematics is employed to the study of this concept, one has to face the problem of nonlinearity, an unsettled problem of mathematics. From the blown-up theory (Wu and Lin 2002), it has been shown that mathematical nonlinearity is about the structures of the entities involved. So, to fully understand elementary concept such as demand and supply in economics, the quantitative, formal analysis has to be modified accordingly. Because of this end, we lay down the theoretical foundation

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for the introduction of the systemic yoyo model and its methodology into the research of economic entities, organizations, relationships, and evolutions.

Next, we apply such a yoyo structure to model the evolution of competitions between economic sectors and individual enterprises from the moment when a sector or an enterprise is born to the time when it is gone. By looking at economic competitions as interactions of several or many spinning yoyos in the light of evolution, we are able to readily employ the methods and results discovered and well developed in fluid dynamics to the research of economics and other branches of social science.

Thirdly, five case studies are utilized to demonstrate the various stages of evolution existing in the general development of economic sectors or business enterprises. Here, in the first case we look at the appearance of personal computers in the second half of the twentieth century in order to show on the basis of systemic yoyo model that when new technology is developed and new gadgets are designed and manufactured, corresponding new business opportunities will generally be sensed by scores of pioneers who hope to cash in on the bonanzas. This becomes particularly true when it is clear that a new industry is emerging and is catching on and money is to be made and fame achieved. In the second case the mutual interactions between American beer brewers are considered to demonstrate that the perception of quality in everyday, inexpensive products can enable their producers to raise prices and enjoy greater-than-standard profit margins. It is why Marlboro and Camel outsell generic cigarettes, Coke and Pepsi do better than store brands, and why the national brands of gasoline do much better than the off hands brands that charge a nickel or a dime less per gallon.

The third case analyzes the development path of Packard automobiles, which once represented the pinnacle of the luxury class of all American cars, and were preferred by the wealthy and powerful from across the globe. This example shows that some companies and products have names that are synonymous with quality, class, and exclusivity. However, the number of such companies and products are not many. They constitute an exclusive club. This end implies that some companies and products established themselves with certain cachet while others target different sectors of the market. For instance, Parker produces a fine fountain pen and Seiko a perfectly acceptable wristwatch, but they are not targeted by "knockoffs," as are Monte Blanc and Rolex. Why? Rolex and Fendi deemed in special categories because of their craftsmanship. Parker and Seiko are considered mass produced. When comparing these classes of companies and products, this case study shows that managements of companies producing fine products face strong temptations to put out popular-price versions. Not content to merely maintain tradition and image, some seek to expand in order to capitalize on fame and to reap a larger volume of trade and profits. However, almost always they fail. What would happen if Chanel put out a low-priced line of perfumes? Or Fendi sold a $20 handbag? Who then would buy the $200 perfume, the $400 handbag? A firm that acted in such a manner would soon lose its buyers who prize craftsmanship and probably would not gain enough customers on the lower end to make up for the difference. Once the magic associated with the marquee is gone, the aura of distinction evaporates. The product becomes common and in some cases vanishes altogether.

The fourth case looks at the E. J. Korvette, a pioneer in discount retailing and marketing. This study shows how entrepreneurs and managers can be different in terms of either focusing on what they do the best that fills a niche perfectly or move readily from one business or product to another. For the former, a good example is David Sarnoff of RCA, which grew from radio-receiver manufacture to radio stations to networks, phonographs and then records, motion-picture theaters and a studio, talent agencies, and so on. Almost everything David was interested in had some relationship to entertainment and electronics. For the latter scenario, Minnesota Mining & Manufacturing is one of those hybrids that fashioned its success not only out of extensions of existing talents and capabilities, but also was willing to search a bit. The company began with a mine from which the founders hoped to extract corundum, a mineral used in grinding wheels. They did not find corundum, but rather anorthosite, which was a relatively softer material. So, those founders used what they found in sandpaper manufacture. Sandpaper required adhesives to bind the sand to the paper, and the company developed them. Out of that came a cloth abrasive known as Three-M-Ite, and then the company purchased the rights to a waterproof sandpaper, Wetordry, which had a huge market in the automobile industry in the painting of cars. There were of course losers, such as a new automobile wax, which, however, brought the company to a closer to relationship with the automobile industry.

The concluding case study focuses on a relatively detailed account of the development trajectory of Montgomery Ward, the long time rival of Sears Roebuck. This example captures the concept of systemic whole evolution in its entirety. This chapter is concluded with some final remarks in Sect. 8.4.

8.1 Demand and Supply: Interactions of Economic Forces

Let us consider a market controlled completely by free competitions. In such an ideal market the price P of a consumer good is closely related to and determined by the demand D and the supply S. Assume that the changes in P is directly proportional to the difference of the demand and supply:

$$\frac{dP}{dt} = k(D - S), k > 0, \tag{8.1}$$

where t stands for time and k a constant. With all other variables fixed, assume that both the demand D and the supply S are functions of the price P:

$$D = D(P) \text{and } S = S(P). \tag{8.2}$$

The relationship between the demand D and the price P is generally linear. We can write

$$D(P) = -\lambda P + \beta, \lambda, \beta > 0, \tag{8.3}$$

where λ is the rate of change of the demand with respect to the price P and β the saturation constant of the demand.

As for the relationship between the supply S and the price P, it is generally nonlinear. It is because when the price of a consumer good lowers, the number of buyers will increase and the demand consequently increases. The increased demand stimulates the production of the good so that the supply is increased. If the price gradually increases, the demand will accordingly decrease so that the supply will consequently be lowered. Since the demand and the supply are not correlated directly, when the price reaches certain height, even though the demand continues to drop, the supply might be increased because the increased price can stimulate the production (Fig. 8.1). Therefore, the relation of the supply with respect to the price is generally nonlinear. This relationship can be written symbolically as (at least by means of local approximations):

$$S(P) = \delta + \alpha P + \gamma P^2, \tag{8.4}$$

where $\delta > 0$ is a constant, α and γ are respectively the linear and nonlinear intensities of the supply, satisfying $\alpha > 0$ and $\gamma < 0$.

Substituting Eqs. 8.3 and 8.4 into Eq. 8.1 produces

$$\frac{dP}{dt} = AP^2 + BP + C, \tag{8.5}$$

where $A = -k\gamma > 0$, $B = -k(\lambda + \alpha) < 0$ and $C = k(\beta - \delta) < 0$.

For Eq. 8.1 or 8.5, the majority of the literature focuses on the study of the price stability at the demand-supply equilibrium, while ignoring the whole evolutionary characteristics of the price. Since the price evolution model (Eq. 8.5) is quadratic, the price in general changes discontinuously and has the characteristic of singular reversal transitions. In particular, let the discriminant of Eq. 8.5 be

$$\Delta = B^2 - 4AC = k^2\left\{(\lambda + \alpha)^2 + 4\gamma(\beta - \delta)\right\},$$

then we have three possibilities: $\Delta = 0$, $\Delta > 0$, and $\Delta < 0$. In the following, let us analyze the evolution model in each of these cases.

Case 1 When $\Delta = 0$, at the equilibrium there is only one equilibrium price $P_1 = -\frac{1}{2}\frac{B}{A} > 0$. The characteristics of the whole evolution of the price are described by

$$P = -\frac{1}{2}\frac{B}{A} - \frac{1}{P_0 + At}, \tag{8.6}$$

where P_0 is the integration constant determined by the given initial condition. If $P_0 > 0$, the price P decreases continuously with time and approaches the equilibrium state $\left(-\frac{1}{2}\frac{B}{A}\right)$. If $P_0 < 0$, then when $t = t_b = -\frac{P_0}{A}$, a discontinuity occurs to the price change. When $t < t_b$, the greater the demand the higher the price. When $t = t_b$, the price falls abruptly, indicating the fact that either the demand

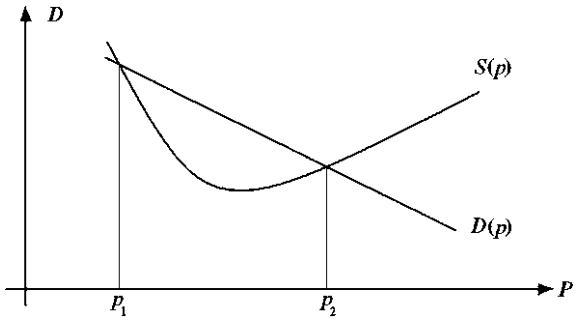

Fig. 8.1 The functional relationships of the demand and supply on the price

reaches its level of saturation or the supply increases drastically, causing the abrupt drop in the price. When $t > t_b$, the price starts to rebound continuously with time and eventually approaches the demand-supply equilibrium P_1. This process indicates that through the market adjustment, the price is no longer growing as blindly as during the first period of time. Instead, by taking the market situation into consideration, to keep a reasonable equilibrium between the supply and demand, the price eventually stabilizes within a certain range.

This whole evolution analysis of the price is not only more complete than the stability analysis at the equilibrium, but also more practically realistic than studies of continuous evolutions when compared to the objective situations existing in the marketplace of free competitions.

Case 2 When $\Delta > 0$, solving Eq. 8.5 leads to

$$\left|\frac{P+\frac{1}{2}\frac{B}{A}-\frac{1}{2}\sqrt{\frac{B^2}{A^2}-\frac{4C}{A}}}{P+\frac{1}{2}\frac{B}{A}+\frac{1}{2}\sqrt{\frac{B^2}{A^2}-\frac{4C}{A}}}\right| = \exp\left(A\sqrt{\frac{B^2}{A^2}-\frac{4C}{A}}t+P_{20}\right), \tag{8.7}$$

where P_{20} is the integration constant. If $\left|P+\frac{1B}{2A}\right| < \frac{1}{2}\sqrt{\frac{B^2}{A^2}-\frac{4C}{A}}$, then Eq. 8.7 indicates that changes in price are continuous. Otherwise, Eq. 8.7 indicates that the price evolution contains blown-ups.

Case 3 When $\Delta < 0$, solving Eq. 8.5 produces

$$P = \frac{1}{2}\sqrt{\frac{4C}{A}-\frac{B^2}{A^2}}\tan\left(\frac{A}{2}\sqrt{\frac{4C}{A}-\frac{B^2}{A^2}}t+\frac{1}{2}P_{30}\right)-\frac{1}{2}\frac{B}{A}, \tag{8.8}$$

where P_{30} is the integration constant. This equation implies that at $t = t_b = \frac{2}{\sqrt{\frac{4C}{A}-\frac{B^2}{A^2}}}\left(\frac{\pi}{2}+n\pi-P_{30}\right), n = 0, \pm1, \pm2, \ldots$, periodic blown-ups in the price

occur. That is, the price of the consumer good shows the behavior of periodic rise and fall.

From the physical and mathematical characteristics of nonlinearity, as studied in the first part of this book, this simple analysis above shows that the concept of demand and supply is in fact about mutual restrictions or mutual reactions of different forces under equal quantitative effects (The concept of equal quantitative effects was initially introduced by OuYang (1994) in his study of fluid motions. And later, it is used to represent the fundamental and universal characteristics of all materials' movements (Lin 1998a). By equal quantitative effects, it means the eddy effects with non-uniform vortical vectorities existing naturally in systems of equal quantitative movements is due to the unevenness existing in the structures of materials. In this definition, by equal quantitative movements, it means such movements that quasi-equal acting and reacting objects are involved or two or more quasi-equal mutual constraints are concerned with. For example, in a principal–agent problem, the principal and the agent can be seen as quasi-equal parties. Each interaction between them can be seen as an equal quantitative movement. The effect of such a movement can be seen as an equal quantitative effect. Lin (2007) shows that if Einstein's concept of "uneven time and space" of materials' evolution (Einstein 1997) is employed, Newton's second law of motion actually indicates that a force, acting on an object, is in fact the attraction or gravitation from the acting object. It is created within the acting object by the unevenness of its internal structure. So, as soon as calculus-based mathematics is employed to the study of such a relationship as that between demand and supply, one has to face the problem of nonlinearity, which is an unsettled problem of mathematics. With the introduction of blown-up theory (Wu and Lin 2002), it has been shown that mathematical nonlinearity is about structures of the entities involved. So, to understand nonlinearity, the quantitative, formal analysis needs to be modified accordingly. To overcome the difficulty encountered by the traditional mathematical methods in the area of weather forecasting, OuYang (Wu and Lin 2002) proposed the idea of blown-ups and a practical procedure based on the vorticity of materials to resolve evolution problems. In particular, his method is developed on the basis of classifications of materials' structures according to their vectorities and has been proven effective in forecasting (nearly-) zero-probability, disastrous weather conditions. For more details to this end, please consult with Part 5 in (Lin 2008b).

On the basis of OuYang's and his students' successes in weather forecasting and the relevant intensive theoretical analysis (Lin 1998a), Wu and Lin (2002) introduced the systemic yoyo model for each object and every system imaginable. In particular, this model says that each system or object considered in a study is a multi-dimensional entity that spins about its invisible axis. If we fathom such a spinning entity in our three-dimensional space, we have a structure as shown in Fig. 4.1. The black-hole side sucks in all things, such as materials, information, investment capital, and human resources, etc. After funneling through the short narrow neck, all things are spit out in the form of a big bang. Some of the materials, spit out from the end of the big bang, never return to the other side and some will. Such a structure, as shown in Fig. 4.1, is called a (Chinese) yoyo due to

its general shape. More specifically, what this model says is that each physical entity in the universe, be it a tangible or intangible object, a living being, an organization, a culture, an economy, etc., can all be seen as a kind of realization of a certain multi-dimensional spinning yoyo with an invisible spin field around it. It stays in a constant spinning motion as depicted in Fig. 4.1. If it does stop its spinning, it will no longer exist as an identifiable system and all the orbiting materials will be absorbed by other spinning yoyos.

Experimental evidence for the existence of such a model is provided in (Lin 2007). Empirical studies of such a structure are given by (Ren et al. 1998). The theoretical justification for this model is OuYang's theory of blown-ups (Wu and Lin 2002). The mathematical foundation of this yoyo model is Bjerknes's Circulation Theorem (Hess 1959). Some initial successful applications of this model in physics, astronomy, and the famous three-body problem are given in (Lin 2007, or Chaps. 4–6 in Lin 2008b). For our current purpose, let us see how such a structure can be employed to model and analyze the evolution of and interaction between various business entities and individual enterprises.

8.2 Yoyo Evolutions Implicitly Implied in Economic Cycles

For the sake of convenience of presentation, let us look at the general situation for a new economic sector or a commercial company to appear and to evolve. To do so, let us see each existing economic sector or an individual company as a spinning yoyo, where the sector's products or services are the materials spit out of the big-bang side and the profits and other economic benefits the materials sucked into the yoyo from the black-hole side. When several spinning yoyos co-exist side-by-side, Fig. 8.2, their mutual interactions lead to appearance of new products and new services, the subeddies in Fig. 8.2. To cash in on the profit opportunities coming along with the new products and services, a new economic sector or new companies are born. To this end, see Case Study 8.1 in Sect. 8.3 for a more detailed demonstration.

At this stage of evolution, the technology of producing the new products is generally quite inefficient, since it is a preliminary combination of the technology and equipments from various existing sectors where the idea of the new products were initially based on. So, the situation will be either that the cost of production is quite high or that the products are unable to occupy a large percentage share of the vast market. Also, because these new products/services do not occupy any market share or/and relatively unknown in the marketplace, the demand for the products/services is very small. Consequently, the development in terms of mass production is slow. Even though the spinning of the new yoyo seems to be slow, the gradually increased market awareness and demand indicate that a new technology needs to be introduced. And, the increasing spinning strength of the yoyo provides the adequate capital for such a needed technological innovation. To this end, Case Study 8.2 in Sect. 8.3 illustrates how the situation could be and in which way it could potentially be changed.

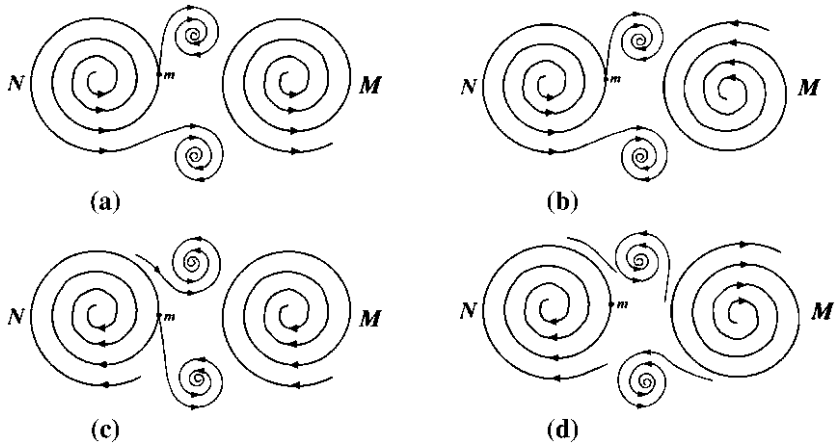

Fig. 8.2 Some ways small yoyo structures can be possibly created. **a** Object *m* is located in a diverging eddy *N*. **b** Object *m* is located in a diverging eddy *N* and pulled by a converging eddy *M* and pulled or pushed by a diverging eddy *M*. **c** Object *m* is located in a converging eddy. **d** Object *m* is located in a converging eddy *N N* and pulled by a converging eddy *M* and pulled or pushed by a diverging eddy *M*

Before we move on to the next stage of development, let us analyze the interactions between the spinning yoyo fields *N* and *M* in Fig. 8.2. For the situation in Fig. 8.2a, because both *N* and *M* are divergent, the subeddies appearing in the discontinuous zones between the rotational fields of N and M have the potential to be maintained and to develop into some self-sustained entities. For the situation in Fig. 8.2b, because the field of *M* converges, no matter how well supported the subeddies, whose materialistic existences are mainly guaranteed by the divergence of the field *N*, in the discontinuous zones between the fields *N* and *M*, the newly formed subeddies sooner or later will be absorbed by the convergent *M*. That is, in terms of newly emerging business entities, these fledgling subeddies will eventually emerge into the existing, powerful business entity *M*. For the scenario in Fig. 8.2c, because both fields *N* and *M* are convergent, the subeddies appearing in the discontinuous zones between the rotational fields of *N* and *M* have to be extremely careful in terms how they move; otherwise they would be taken (or hostile takeovers) by either *N* or *M*. The scenario in Fig. 8.2d is similar to that in Fig. 8.2b with the roles of *N* and *M* exchanged, the analysis is omitted.

With this systemic yoyo model analysis in place, let us now move on to the second stage of evolution in economic cycles. In this stage trend-following companies start to pop up at a high speed, similar to the situation that when a calm pond of water is initially disturbed, instead of a big whirlpool is created, many areas of the water start to move. As a consequence, the relevant investment in terms of capital and human resources is drastically increased and the production level is brought up to a higher level. In order to gain a winning edge in the market

competition in terms of market shares (the diverging side or big-bang side of the yoyo) and of revenue (the converging side or the black-hole side of the yoyo), the technology for mass production is improved and becomes more efficient with lowered costs (the spinning strength of some yoyos become strong). So, the market share of this new economic sector, led by a few strong representative companies, opens up quickly. Case Study 8.3 in the following section explains how historically this second stage of economic evolution plays out.

After entering the third stage of evolution, the marketplace is gradually saturated with a more-than-sufficient supply. As the revenue increases, the profit elasticity of the products and services starts to erode. So, due to the weakening profit margins (fewer materials can be sucked in from the black-hole side), further advances become slower and more difficult. At the end, the entire sector stops any attempt for further advancement. And the production stabilizes at the level of replacing aged and broken products purchased earlier. As a yoyo's spin become weaker, meaning that fewer materials are spit out (from the big-bang side) and sucked in (from the black-hole side), caused by appearances of other different but relevant new yoyos (economic sectors or companies), the yoyo might be absorbed by another faster and stronger spinning structure, or simply destroyed by several adjacent more energetic yoyos. For a more detailed demonstration for this end, please consult with Case Study 8.4.

As a matter of fact, each real-life economic entity goes through such a three-staged lifespan with some minor variations. In order to make this conclusion more vivid, a relatively detailed account of the development trajectory of Montgomery Ward is presented in Case Study 8.5.

One characteristic of the previous yoyo model analysis is about looking at the problem of concern as mutual interactions between several spinning yoyos and rotational fields, that is, from the angle of evolution. It is a dynamic model instead of a static one. Because of this characteristic, one can reasonably expect that such a model can help to bring forward new insights into various existing and new researches. As what we have done in the earlier chapters, in the following chapters in this part of the book, we will look at several applications of this yoyo model in business-related discussions to prove this point.

8.3 Case Studies

In this section, we will employ case studies to illustrate the abstract systemic yoyo model analysis of economic cycles. At the same time, when possible, we will also draw relevant systemic conclusions or conjectures regarding the underlying laws of systems science.

Case Study 8.1 In this study, we will look at the appearance of personal computers in the second half of the tewntieth century to demonstrate that when several spinning yoyos co-exist side-by-side, as shown in Fig. 8.2, their mutual interactions lead to appearance of new products and new services, which are the symbolic

subeddies in Fig. 8.2; and to cash in on the profit opportunities coming along with the new products and services, a new industry and new business enterprises are born. This presentation is mainly based on (Sobel 1999a, pp. 1–26; Ahl 1984; Freiberger and Chew 1980).

As what we have discussed earlier in this book, in the discontinuous zones (Fig. 8.2) between two spinning yoyo fields, there might exist subeddies, depending on how the yoyo fields spin. These subeddies are jointly created by the yoyo fields through constantly feeding the discontinuous zones with force and materials. This fact explains why when new technology is developed and new gadgets are designed and manufactured, corresponding new business opportunities will generally be sensed by scores of pioneers who hope to cash in on the bonanzas. That end becomes particularly true when it is clear that a new industry is emerging and is catching on and money is to be made and fame achieved. For instance, in the USA during the fifty's of the twentieth century, there were hundreds of franchised fast-food companies serving hamburgers, hot dogs, pizza, and sandwiches. Soon after that period of time, ethnic foods arrived, such as Mexican and all other imaginable cuisines. Seeing the successes of some of these chained operations in the food industry, other entrepreneurs created franchised business opportunities in many different areas of commercial endeavors, such as motels, rental equipment, temporary services, hospitals, carpet cleaning, and so on. As the systemic yoyo model in Fig. 8.2 and the analysis on the interactions of spinning fields indicate, most of such franchised operations have to end in failures. For instance, for every McDonald's there are many failed Burger Chefs; behind each Holiday Inn people could easily find the wreckages of other related business attempts, such as the Motel World. For related details and events, please refer to (Hoge 1988; O'Neill 1973; Herndon 1972).

For the second half of the twentieth century, computers, first as mainframes and then as personal computers, were the most important product. These two species of machines were initially different kinds produced for very different sets of applications out of strikingly different origins. The leading companies for mainframes included old-line business-machine companies such as IBM, Remington, Rand, Burroughs, and NCR, and electronics firms, such as General Electric, RCA, Honeywell, and others. As for personal computers, the year of 1971 is seen as the start of the movement of microcomputing, when Marcian Hoff of Intel designed and created the first microprocessor, the heart of small computers. As analyzed in our systemic yoyo model, for the development of personal computers, the successful creation of this product signaled the consequent appearance of massive amount of subeddies, companies that turned out microcomputers.

For specifically, for instance, Instrument Telemetry Systems, an electronics firm located in New Mexico, in 1975 created a kit, named Altair, from which hobbyists could assemble computer at homes. Following the idea, several other kits, catering to hobbyists, soon followed. In the late 1970s, Commodore International created preassembled desktop computer named PET; Heath offered similar products that could be ordered from catalogs; and Radio Shack sold the TRS-80. During the same time period, many other start-ups, such as Computer

Faire, Mountain Hardware, IBEX, the Bay Area Computer Stores, and Processor Technology, appeared in the scene. It was estimated, by the industry's monitor, Dataquest, in 1983 that there were more than 800 firms that produced personal computers. Among all these entrepreneurs were Bill Gates of Microsoft and Michael Dell of Dell Computers. They started and then successfully ran their own companies and eventually made themselves the richest men in the world. Such are the rewards of success in new industries. Generations earlier, Andrew Carnegie, Thomas Edison, Henry Ford, and others also made their fortune and fame during their periods of greatness.

The then observers of the business world, based on their knowledge of the history, expected that once the old-line firms entered the fray, most of these 800 some fledgling firms would not survive. However, the newcomers, one of their representatives was Adam Osborne, held on to the opposite, believing that the companies of the mainframes were dinosaurs that were on their way to extinction. To make our analysis more detailed, in the following, let us look at a specific start-up company, the Osborne Computer Corp., and see how it was swallowed in the ocean of business eddies and their interacting forces.

Osborne like many other entrepreneurs of the time also started his own computer manufacturing company in 1979 after first achieved his fame and made his first pot of gold by serving as one of the most visible spokesmen of the microcomputer industry in the 1970s. To take care of the hardware end, he hired Lee Felsenstein. With $5,000 of his own funds, Osborne raised $900,000 by the time when he was ready to demonstrate his product. Then, he set out to reach deals with software companies. For instance, among others, with MicroPro, a software company that recently produced the word procession program WordStar, he obtained a deal for 75,000 shares of stock in his company, worth about $130,000 based on the cash he had raised; and from the new start-up company Microsoft, he received BASIC, a computer language also for shares of his company stock. To manufacture and market his computers, Osborne in January 1981 incorporated his company.

By spending $6 million on advertisement, Osborne computers were received very well when they arrived in retail stores. Adam Osborne had his first million-dollar month just three months after his first machine was sold. After subtracting the start-up costs and other one-time charges, Osborne Computer Corp. experienced a $1.2 million loss in 1981.

On August 12, 1981, shortly before the Osborne 1 was introduced, IBM, which at the time was synonymous with computers, announced its PC products with a great deal of fanfare. And, the following year, Compaq, a firm newly organized by former Texas Instruments engineers near Houston, along with many other companies, also supplied their transportable computers to the market place. Different from Adam Osborne and most other entrepreneurs in the PC world of the time, these engineers at Compaq, factually believed that IBM would be a sure winner so that they acted on this assumption by focusing on building better IBM machines than IBM could. Their success came out of the strategy that the products of Compaq were designed for those people who had an IBM in the office and wanted

an IBM on the road or at home. That is, instead of fight against the existing giant(s), Compaq designed its products and planned their success by piggy riding on the back of a sure winner of the market place.

Unlike Osborne Computer Corp. and many others, for 1983, Compaq posted revenues of $111 million. Noticing such a phenomenal success for a start-up, IBM delivered its first transportable a year and half later and shared 75% of the market with Commodore, Apple, and Radio Shack, the other then-leaders of the industry. By cashing on a mistake IBM made about not upgrading the Intel 286 chip to the 386 (due to conflicts with its existing products), Compaq immediately stole sales from IBM while establishing the market belief that Compaq was making the best IBM desktops.

Walking along a path completely opposite to that of Compaq, Apple gambled on retaining its unique operating system and refusing to bow to IBM, believing that its software was superior to anything IBM could offer and in the end would prevail. So, it seemed at the time that all other firms would join IBM or Apple. However, it did not happen that way. By making its architecture open, IBM invited clones, such as Compaq, in its attempt to establish a single accepted standard for the industry. And, in refusing to accept clones and then clobbering a small company, Franklin, when it came out with a compatible, Apple opted for all or nothing.

As for Osborne Computer Corp. due to the non-existent quality control, Osborne's personal harsh relationship with the retailers, and the sudden change in the market conditions, as described above, it began to decline before it ever made any profit until its filing of Chap. 11 bankruptcy on September 14, 1983. If using our systemic yoyo model, what Compaq did was create a rotational field that was supported by two diverging fields, one Intel and the other IBM, from the former Compaq acquired its hardware, the chips, and from the latter it adopted the well-received architecture. On the other hand, from the very start Osborne Computer Corp. tried to fight against the giant, IBM, whereas it tried to establish its own identity and territory in the market place. Inevitably, it was crashed before it could have even found its place to put down its first foot.

Among many lessons to be learned in this case study is that a product does not have to on the cutting edge to be accepted by the market. Instead, the producer has to make the product adequate, properly supported, and readily available.

Case Study 8.2 Continued from the previous case study, where it was shown that when several spinning yoyos co-exist side-by-side, their mutual interactions lead to appearance of new products and new services, which are the symbolic subeddies in Fig. 8.2; and to cash in on the profit opportunities coming along with the new products and services, a new industry and new business enterprises are born. In this case study, we demonstrate by using the mutual interactions between American beer brewers that along with the birth of a new industry, the technology of producing the new products is generally quite inefficient, since it is a preliminary combination of the technology and equipments from various existing sectors where the idea of the new products were initially based on, and how the situation could potentially be changed. So, the situation will be either that the cost of production is quite high or that the products are unable to occupy a large

percentage share of the vast market. Also, because these new products occupy no share of and relatively unknown in the marketplace, the demand is very small. Consequently, the ability of mass production is slow. Even though the spinning of the new yoyo field, the newly appeared industry, seems to be slow, the gradually increased market awareness and demand indicate that a new technology needs to be introduced. And, the increasing spinning strength of the yoyo field provides the adequate capital for such a needed technological innovation. The presentation of this case study is mainly based on (Sobel 1999a, pp. 127–146). For other relevant details and events, please consult with (Christensen 1977). For the convenience of understanding this analysis in terms of our systemic yoyo model, each brewer, each customer group, and each potential consumer market are seen as spinning yoyos interacting with each other in order to gain control of the others.

Today the big three of beer producers in the United States are Anheuser-Busch (maker of Budweiser), the national leader, and its distant followers Miller (maker of Lite) and Coors (maker of Colorado). Beneath these big three are the economy brands, such as Stroh, Erlanger, Goebel, Schmidt, Blatz, Pabst, and Schlitz. All of these brands once were local and regional with loyal followings, except that a century ago, Anheuser-Busch was one of the big three along with Pabst and Schlitz, and often these two outsold Budweiser.

In the mid-nineteenth century when German lager beer became popular, German American families founded breweries in every town across America. And, large cities often had more than a dozen of breweries. These operations remained family affairs until the end of World War II. And, in as late as 1961 the 13 members of the Schlitz board consisted of eight Uihleins and five sons of mothers whose maiden names used to be Uihlein. In that year, only four of the nation's 10 largest breweries, Anheuser-Busch, Schlitz, Falstaff, and Pabst, were publicly owned. With the end of the Prohibition, there came new leaders in the industry who were inspired to quest for new markets and acquire greater land territory. That is, changes in the law had provided the soil for existing dormant yoyo fields (brewers) to become active and to acquire their strengths for taking new territories.

However, challenging local brews was difficult, because their local customers remained loyal. That was why Milwaukee remained devoted to Schlitz, Pabst, and Blatz; New York to Ruppert and Schaefer; Philadelphia to Schmidt; and St. Louise to Budweiser and Falstaff. And, Goetz was popular in Kansas City, Missouri Effinger in Baraboo, Wisconsin; Dixie in New Orleans, and Red Bluff in Red Bluff, California. The situation was like an ocean of spinning fields, where all the pools were about the same size and strength.

With the arrival of refrigeration, pasteurization, and efficient bottling beers were sent farther away from where they were originally brewed. But, discerning drinkers did not like the taste and remained loyal to their locals. Convincing drinkers of various localities that bottled/canned beer was as good as their local, unpasteurized versions was a major challenge for those leaders who hoped to go regional. Finally in the late 1930s the popularity of containerized beer started to accelerate, which brought strong competitive pressures to the industry. That is, as

time went on some regional whirlpools started to form and the originally relative balance of power was broken.

Against the traditional belief that local tastes could not be successfully replicated elsewhere, Pabst was the first to venture into unexplored territory. To augment its malting operations, in 1932 the company acquired the Premier Malt Products Co. of Peoria Heights, Illinois, which prior to Prohibition had been Decatur Brewing Co. Two years later that facility was relicensed as a brewery and turned out Pabst Blue Ribbon beer. After some struggles, Pabst successfully convinced wholesalers that the Blue Ribbon brewed in Peoria Heights was the same as that from the Milwaukee facility. Harris Perlstein, who became president of Pabst along with the acquisition of Premier, was ambitious and spoke expansively of creating a giant corporation with breweries in all parts of the nation. Then war broke out and forced Perlstein to put his plan on hold.

During that conflict, ten million young American men were sent to places far away from their homes and spent a few years drinking and becoming accustomed to different brands of beer produced by leading domestic brewers such as Anheuser-Busch, Schlitz, Pabst, and others. Upon returning from the war, some of these men were unwilling to return to their old beers; they sought out for Budweiser, Schlitz, and Pabst, creating a demand to be filled by taverns and restaurants, the retailers, the wholesalers, and ultimately, the breweries. This demand together with the growth of packaged beer and new forms of advertising and promotion eventually revolutionized the industry. In other words, along with the formation of regional whirlpools in the beer industry, an overwhelming rotational field (the war) appeared; it drew elements of different spinning yoyos together to form their lasting bonds.

With its plan already in place, as soon as the war ended, Pabst made the first move. In 1945 Perlstein entered the New York market by purchasing the Hoffman Beverage Co., a local company that originated as a brewery. He successfully converted part of the facility to the production of Blue Ribbon, and then turned his attention to the West Coast by purchasing Los Angeles Brewing in 1948, where he produced Blue Ribbon which continuously turned out the locally popular brand, Eastside.

Eyeing at the successes of Pabst in the west, Schlitz started to investigate its chances in California. However, for the time being, New York was more important. Other than locals, no major brewers had entered the large New York market. The leaders of Schlitz and Anheuser-Busch, two historical rivals, monitored each other's actions carefully, each intended on not letting the other gain an advantage.

Gussie Busch, CEO of Anheuser-Busch, was an irascible, shrewd, and flamboyant businessman who was absorbed in the task of making Anheuser-Busch the national powerhouse of brewing, while maintaining the integrity of its beers. He replied upon his instinct in making his decisions. On the other hand, Erwin Uihlein, who headed Schlitz in this period, certainly was one of the most distinguished and learned American brewers. His top management was devoted to the goal of making its brewery the most modern and economical in the industry.

When in 1945 Gussie Busch looked at a possible site for a new brewery in Newark, New Jersey, on US Highway 1, across the road from Newark International Airport, in order to tap into the markets of Pennsylvania and New York, both Schlitz and Pabst modernized and expanded their operations and experimented with less expensive ingredients. With the modernization, Schlitz became the leading brewer in 1947 with Anheuser-Busch ranked in the third and Pabst the ninth place. The following year Pabst displaced Anheuser-Busch, which was now the fourth largest brewer.

In March 1950, the ground was broken for the new and modern one-million-barrel facility in New Jersey, which increased Anheuser-Busch's sale by 20% and gave it the lead in the industry. Following that success, in 1953 when it appeared that the St. Louis Cardinals would be sold to Milwaukee interests, Gussie Busch purchased the team and kept it where it was. The grateful St. Louise beer drinkers, who were horrified by the potential that their team would have departed, switched to Budweiser from their originally favorite Falstaff. Also, St. Louis was the major league city that was the furthest south and west, and was avidly followed on radio by fans in these parts of the country. Therefore, Gussie Busch's purchase intrinsically helped rally these fans behind Budweiser and its sister brands. Also, Gussie Busch took the connection of beer and entertainment steps further. He opened the Busch Gardens in Tampa, Florida, close to the company's brewery, becoming the second-largest theme park operator behind Walt Disney.

In comparison, both Schlitz and Pabst also had sports connections, where Schlitz started broadcasting the games of the nearby Kansas City Athletics, and Pabst continued its coverage of "Blur Ribbon" boxing programs. However, neither Schlitz's nor Pabst's connection with sports had the impact of Gussie Busch's purchase of the Cardinals.

In 1961 44-year-old Robert Uihlein took over the helm of Schlitz from his uncle Erwin with the strategy that Schlitz would produce beer at lower prices than Anheuser-Busch and use the profits to continue modernizing the breweries and aggressively promoting its beer in new markets. One of Robert's first moves had come in 1959 when he convinced his uncle to reintroduce Old Milwaukee to give the firm an entry in the popular-priced market segment. Old Milwaukee was revamped, repackaged, and then reintroduced with a new set of marketing strategies. Sales picked up sharply.

Also at Schlitz, it pioneered in market research at a time when the leaders of other breweries still relied upon their instincts. Schlitz's people researched, developed specific and best programs possible, carried them out, and then wrapped up with evaluations. Its objective was to find out what makes the beer drinker tick and how to get to him on his terms rather than the brewer's. This was quite revolutionary for such an industry that was steeped in tradition. And in terms of management, each of the Schlitz beers had its own brand manager, who was responsible for all phases of operations from brewing to wholesaler relations. With the power went responsibility. The mangers knew that while good performance would be rewarded, a poor showing would not be tolerated. In terms of packaging, Schlitz accounted for several of the pioneering efforts.

By continuously taking advantage of newly developed technologies, Schlitz's new breweries were cheaper to build and operate than those erected by other breweries. For instance, from 1961 to 1965 Anheuser-Busch spent nearly $130 million on new plant and equipment, while Schlitz only earmarked close to $50 million for that purpose. And in the 1970s Schlitz's facilities contained three breweries with capacities of four million barrels that employed fewer workers than facilities a fraction of that size. For instance, one of the antiquated Old Milwaukee breweries employed 24 men on a brew-house shift, the newer ones could be handled with just two. This surely gave Schlitz an edge over other brewers, including Anheuser-Busch. Uihlein was convinced that success in the economic area and marketing would combine to give him the industry lead. This led him to take steps that seemed drastic to traditionalists. For instance, Schlitz did not age its beers as long as Anheuser-Busch did Budweiser and Michelob. These changes at Schlitz worked. Robert Uihlein had reinvigorated the company. From 1968 to 1973, Schlitz sales increased at an annual rate of 13%. In the former year Schlitz had slightly more than 10% of industry sales, and by 1973 Schlitz's stood at 15%.

To conclude this case study, one may ask naturally: If Schlitz did so well with technology, how could it have eventually fallen out of the list of the Big Three in the industry?

To this end, what happened was that along with his successes in brewing, Robert Uihlein ventured away from brewing. In addition to seeking the number-one slot for Schlitz, Uihlein envisioned to transform the company into an international conglomerate, doing so with a buying spree that cost approximately $100 million. Among the acquisitions made in this period were breweries in Turkey, Puerto Rico, Spain, and Belgium. There were Chilean fishmeal plants and a fishing fleet, along with a glass factory and citrus concentrate facility in Pakistan. None was profitable, prompting the hiring of a new financial vice president in 1969 whose major task was to dispose of these ventures. Yet, these failures did not deter Uihlein. He continued seeking new areas of opportunity. The wine business was growing and bore some similarities to beer, so Uihlein went after the Paul Masson and Charles Krug wineries in California, and Nicholas, the largest winery in the world. He failed in all these attempts. Uihlein tried to buy Lawry's Foods and several other specialty operations, only to be rebuffed. He finally succeeded in obtaining Geyser Peak Winery and Murphy Products, the latter a Wisconsin grain company. Then, there was C & D foods, a duck farm, which Uihlein thought would make a fine fit with Schlitz, since it would be a near-perfect market for spent brewery grain to be used as feed. All miscarried and went on the market to be sold at losses. The apparent drift at corporate headquarters resulted in the departure of key executives.

In 1974 Schlitz was reformulated once again, using a number of additives in its beers to enhance appearance and shelf life. It introduced a new brewing process at its Milwaukee facility, known as Accelerated Batch Fermentation, it cut the process from 12 days to less than 4, which promised additional economies. By using lower-cost ingredients and such new techniques, Schlitz was able to reduce the cost of producing a barrel of beer by 50 cents, which in 1974 translated into $9

million. All these changes were being well received by customers, although they were roundly criticized by some in the industry. Along with the handsome savings, Uihlein modified its pricing strategy by increasing the prices to wholesalers, believing that they would be able to pass on the boost to retailers and consumers. But they could not. Instead, the sales in 1975 fell from the torrid pace enjoyed earlier with the growth rate slowing to 6%. Even so, the company was profitable, solvent, and secure.

In late 1975 it seemed clearly to Uihlein that the Food and Drug Administration would oblige brewers to list ingredients on their cans and bottles, although he had been adamantly opposing it. On January 1, 1976, Uihlein sent to his Milwaukee, Memphis, and Winston-Salem breweries to replace a silica gel containing enzymes used in brewing with a substitute called Chill-garde. Supposedly Chill-garde functioned as the silica gel, which was to prolong shelf life and stabilize the beer. This might provide Schlitz with an advertising gambit to counter beechwood aging and the use of rice and expensive hops. And Chill-garde would be removed before the beer was containerized and so would not have to appear as an ingredient on labels should these be required. However, as it turned out, Chill-garde reacted with another ingredient Schlitz used, a foam stabilizer called Kelcoloid, which resulted in the coagulation of protein particles. These appeared in the beer as tiny flakes, giving it a milky appearance. They did not alter the taste and were not dangerous, but would hardly be welcomed by drinkers.

The Milwaukee plant manager noted the change and reported it to headquarters, but for whatever reason, the report was not reacted upon. Then in late February a major recall effort of more than 10 million cans and bottles of beer was issued. The cost in reputation and morale was far more fatal than the financial loss of over $1.4 million. With paranoia running wild in Milwaukee and the field, the problem mounted. And Uihlein seemed incapable of turning the situation around. To further complicate the matters, at the same time in this period Schlitz was the subject of several government investigations alleging violations of postal, income tax, and anti-trust laws. It also faced accusations of having given kickbacks to retailers for offering Schlitz rather than competitor's brands.

In October, Uihlein learned that he had leukemia and died two weeks later, leaving no designated and prepared successor. Along with the chaos, sales declined by almost 10% as Schlitz fell to third place in the industry with a less than 14% market share in 1977, in which the board hired Daniel McKeithan, a geologist by education, to be the CEO, believing that McKeithan had the drive and imagination to do the job. McKeithan promptly raided Anheuser-Busch to hire its top lieutenant Frank Sellinger. Realizing he had to retrench before attempting a comeback, Sellinger shuttered the landmark Milwaukee brewery, sold the three-year-old Baldwinsville facility to Anheuser-Busch for $100 million, and other steps to cut costs and bring Schlitz under control.

In 1981 Sellinger attempted to resolve some problems by buying Stroh. If successful, the merger would create a much larger concern, which might compete with Anheuser-Busch and Miller on several fronts. But nothing came out of this. Instead, Schlitz itself was pursued by its old rival, Pabst. This was what the

Uihleins wanted and what they intended to have happen. However, the Justice Department ruled the merger a violation of anti-trust law and Pabst's offer of $588 million for Schlitz did not go through. In 1982 through some persistence Stroh acquired Schlitz.

One of the many lessons to be learned in this case study is that when a company tries to attract the attention of one specific economic pool of customers, also seen as a rotational field, it has to spin in a direction and strength the customer pool could accept. Otherwise the specific customer pool would direct its attention to other compromising fields that are more harmonic to the customer pool. In ordinary language, it means that no matter how successful a company is, it has to respect the feedback from its customers.

Case Study 8.3 Here, we show by using the specific case of Packard automobiles, which once represented the pinnacle of the luxury class of all American cars, and were preferred by the wealthy and powerful from across the globe, how the second stage of economic evolution plays out historically. According to the systemic yoyo model analysis, in this second stage of evolution, trend-following companies start to pop up at a high speed, similar to the situation that when a calm pond of water is initially disturbed, instead of a big whirlpool is created, many areas of the water start to move. As a consequence, the relevant investment in terms of capital and human resources is drastically increased and the production level is brought up to a higher level. In order to gain a winning edge in the market competition in terms of market shares (the diverging side or big-bang side of the yoyo) and of revenue (the converging side or the black-hole side of the yoyo), the technology for mass production is improved and becomes more efficient with lowered costs (the spinning strength of some yoyos become strong). So, the market share of this new economic sector, led by a few strong representative companies, opens up quickly. This case analysis is based on (Sobel 1999a, pp. 107–126). For relevant details and events, please consult with (Anderson 1950; Dawes 1975; Rae 1968; Schroeder 1974; Turnquist 1965; Rottenberg 1988; Ward 1995).

At the turn of the twentieth century there were thousands of automobile producers in the United States. The situation in auto industry of the time was very much like that in personal computers of the 1970s. There was indeed more than a passing resemblance between these two periods of time. Almost all of the pioneers of the automobile industry were tinkerers and interested amateurs. They manufactured and sold their cars to a market comprised of affluent and invariably wealthy trendsetters until came Henry Ford, who through technology made cars no longer a symbol of wealth but the triumph of the common man over time and distance.

In 1893 James and William Packard, who were brothers and owned a successful electrical equipment business, contracted auto fever and began tinkering with cars. Two years later William purchased a De Dion-Bouton buggy and in 1898 James acquired his first car, a Winton. As one would have expected, the Winton suffered from many mechanical problems. So James, who was the mechanic in the family, traveled from his home in Warren, Ohio, to Cleveland to complain to Alexander Winton, who then manufactured cars in a shed behind his bicycle company and

three years later would be the second-largest American manufacturer. Seeing what was all in the shed and hearing what Winton had to say, James told William what had transpired in him and convinced his brother it was a good idea.

At that point in time founding an automobile company took little more than a generalized interest in the product, a bit of capital, and a place where parts purchased from suppliers might be assembled. With the help of a former Winton employee, George Weiss, Packard & Weiss was created in late 1899 with James chipping in with $6,000 and Weiss $3,000. Their first car was designed and built by Weiss and another former Winton worker and rolled out of the shed in that year. The company assembled three cars in 1900, and five in 1901. By then the company's name was changed to Packard. At an auto show these first Packard cars captured the imagination of such important individuals as William Rockefeller and Henry B. Joy. William purchased three of the 1901 cars and Henry bought one and was impressed by its beauty. Sensing a great opportunity based on his successful background in railroad and real estate, Joy went to see the Packard brothers, purchased a majority interest in the company, and moved Packard to Detroit.

In 1904, the first full year in Detroit, Packard produced 250 cars, marking it the eighth-largest car company in America. And during the next 15 years, Joy singlehandedly lifted Packard into one of the industry's leaders by replacing the Packard's feeble one-cylinder engine with a four-cylinder powerhouse, helping design a massive radiator, a Packard trademark, and advertising. Most importantly, Joy created the competent distribution network by selecting, monitoring, and inculcating dealers with his vision. All the showplaces where Packards were displayed demonstrated the company's esprit. America's aristocrats shopped there as they might at an art gallery. Customers were invited to consult on the design of their cars, and many were custom fashioned by renowned coach makers. Because Packard stood at the pinnacle of the luxury class, profits were high and sales not particularly difficult. During this period, Packard was ahead of its competitors, Peerless, Piece Arrow, Lincoln, and Cadillac. And, under Joy's leadership, Packard manufactured a distinctive line of high-priced cars.

In 1910 Alvan Macauley, a former patent attorney, joined Packard as the general manager. He was dour and conservative, concerned primarily with the bottom line and dedicated to preserving the Packard image, with Joy being imaginative and innovative. They worked well as a team and shared a penchant for quality. In 1914, Joy resigned so that the company was turned over to Macauley. Opposite to Henry Ford's approach, Packard focused on handmade parts and custom tooling, and fashioned Packards lovingly one at a time.

In 1921, for the first time an incoming United States president rode to his inauguration in a car. Warren Harding arrived at the reviewing stand in the back seat of a Packard. And during the presidency of his successor, Calvin Coolidge, there were seven Packards in the White House garage. Packard was the preferred car for Supreme Court Justices and affluent legislators. It was the official royal automobile in Belgium, Egypt, India, Japan, Norway, Rumania, Saudi Arabia, Spain, Sweden, and Yugoslavia, and in the republics of Chile, El Salvador, and Mexico.

In that year, Macauley had his staff produce a six-cylinder engine to be placed in a smaller car. As it happened, sleeker models were coming into vogue. The company's plan was to market the six as an off-the-floor luxury car, while the eight-cylinders would be customized. Packard six-cylinder cars performed very well. However, Macauley was troubled by this success. By then mid-priced cars such as the Buick, and Dodge were offering six-cylinder models for $800 to $1,000 less than the cost of a Packard six. Did Packard truly want to produce cars that were considered to have less status than the eights? Two years later the company came out with a new eight-cylinder engine, more powerful and efficient than the twin six. In the annual report Macauley wrote: "The Eight in its standard form is equipped with every luxury and embellishment the markets of the world afford… Its riding qualities are unsurpassed… The broadcloths, silks, and fabrics with which the body is trimmed are the finest obtainable… to cater to the wishes of an exacting clientele… we offer a complete line of custom bodies. We have not sought quantity production… best to keep them on a plane where they will always be in demand and where… the demand will be somewhat greater than the supply." The stress on status paid off. For instance, during the 1920s car prices fell steadily, as prices of new products generally do. Not so the Packard, whose prices declined only slightly. And in 1929, Packard's profits came to $25 million, or $577 per car. In comparison, that year Ford produced 1,507,132 cars, with a profit of less than $50 per car.

The Great Depression that followed caused Packard's sales declined to 28,177 in 1930, 13,123 in 1931, 8,018 in 1932, and then to 7,670 in 1933. The company reported losses for 1931 and 1932 and a small profit of $89,000 in 1933. During this period Macauley had to decide where the Packard market and future would hinge and what image Packard had to project because during the Great Depression there were not enough wealthy and famous around to purchase Packards. This meant that Packard's future rested in the midrange part of the market, where there were more sales, but lower prestige and profit margins. (As it turned out, within four years such prestigious marquees as Duesneberg, Franklin, Marmon, Peerless, and Pierce-Arrow all disappeared. So did the insistence on craftsmanship. In retrospect it is obvious the time of the finely crafted car would have ended even without the Depression.) One way to implement this realization was to come out with a different kind of car with a name and dealership arrangement of its own—the way GM had Chevies and Cadillacs, each with its own constituency. However, Packard lacked the resources for such an approach.

In 1935, Macauley brought out the 120 for $1,060. It was an enormous success. From January through October 1935, Packard produced 24,995 of them. The production rose to 80,699 in 1936. Macauley seemed to have hit upon a strategy that worked. And the reason behind this success was due to Macauley's ability in convincing middle-class drivers that they were getting a true Packard: the 120s looked like the old Packards; the reputation for craftsmanship remained years after the company had bowed to the dictates of mass production. In 1937 as the nation suffered through a steep economic slide, Packard production was a record 109,518. Justifiably believing he had found the right formula, Macauley introduced the 110

at around $800. It sold well. Both the 110 and 120 cars were well made and appealed successfully to upper-middle-class buyers.

With the diminishing sales of the high-priced luxury Packards, Macauley ordered to a discontinuance of custom bodies and the upper end of the line and transferred facilities to the production of the 110 and 120. In 1940, Packard produced a total of 66,906 cars with most of the sales derived from the 110 and 120. By then, Packard in fact was essentially a manufacturer of mid-priced cars.

In 1938 Macauley at age 66 was replaced as CEO by the 50-year-old Max Gilman, who was best known as the man who had led the 120 program. Gilman not only represented the new generation, but also the new company as well. At the helm Gilman immediately introduced the Clipper. The new model was low and wide, sleek, and expensive looking. It was offered in April 1941, and was well received. Then, the United States was involved in the WW II until 1945. As in the case of WW I, during this period, Packard produced military gears and prospered as virtually all sales to the military topped $460 million in 1944 with earnings of $24 million. By the time the war ended Packard's balance sheet showed $41 million in assets and $12 million in liabilities. As for Gilman, in 1940 due to a serious car accident and some personal affairs he was replaced by George Christopher, who had worked at Pontiac until 1934, when he abruptly retired to become a farmer. Given the responsibility of supervising the 110s and 120s, Christopher presided over the erosion of the Packard image. On the other hand, Packard had assets, and was a leader in the development of jet engines, a high priority for the Air Force; and the country was hungry for new cars after a decade of depression and the wartime years of sacrifice and had paid off debts and saved during the early 1940s. Packard's prospects had not been so bright since 1937.

Unfortunately, Christopher was unsuited by temperament and inclination to capitalize upon opportunities. Also, Macauley remained on as chairman and with age (he was 73 years old when the war ended) had lost much of his vigor and keen appreciation of possibilities. He blocked the efforts of younger, more imaginative men. It was one of those instances of a once fine leader who overstayed his usefulness to the company. Macauley finally retired in 1948. And during the car-hungry period Packard sold every car it produced with little difficulty, but it had trouble converting its factories back to car production in a timely fashion. Then for the first three months of 1946 Packard workers were on strike, and there were shortages of just about all the materials that went into making cars. Thus the projected production for that year was cut for more than 50%. During the period from 1945 to 1947, Packard lost more than $8 million. Seeking a solution to the problem, Christopher ordered style changes for 1948, which turned the old loyalists to Cadillac. Even so, Packard cars sold well because anything that moved on wheels sold in the car-hungry postwar period. That year was the first without any production problem at Packard, which turned out 98,897 cars; and Christopher promised 200,000 for 1949. However, the dealers could not sell them due to the styling and the high prices. Instead, Packard sold its surplus engines to other manufacturers who were enjoying booming sales, a sure sign of decline for Packard. Responding to the losses from car productions, Christopher ordered

across-the-board cutbacks, rejected design changes, and insisted upon the use of cheaper upholstery and fittings.

More problematic was the Packard pricing policy. During the 1920s its cars were geared for those for whom price was no problem. With the Clippers of 1941 the company discovered that a midpriced luxury car would sell. So in 1948 Christopher produced the Standard Eight, a luxury model that sold for $500 less than the least expensive Cadillacs, on par in terms of price with the Oldsmobile 98. By then, Packard had a range of offerings with four out of five in the low-price range and young people no longer thought of Packard as a manufacturer of status-enhancing cars. For 1949 production came to 105,000, half of Christopher's forecast. So he resigned. Former treasurer High Ferry now became CEO. "I just was not fit for the job," he later conceded.

From the very start, Ferry focused his energy on naming a successor. All of Packard's executives were old, timid, and dispirited. So, Ferry looked outside the company. In June 1952, the board gave the job to 51-year-old James Nance, who had no experience in the automobile business or in any form of manufacturing. In naming Nance, the board signaled its belief that there was nothing wrong with its cars; rather, the company was experiencing problems of image and marketing.

After a three-week tour of the facilities, Nance perceived Packard's major problem: the once premier American car that had made a successful foray into the midmarket before the war had lost its former customers to Lincoln and Cadillac, and was unable to convince middle-class customers Packard was their kind of car. So, he proposed to abandon the top line entirely and concentrate on the midmarket. Although Nance's analysis was sound, he did not carry through. He established three classes: the Packard Patrician 400 for the super luxury market, the Packard Cavalier, a touring sedan, and the Packard Clipper, where there was a major flaw in the design. While there was little similarity between the Cadillac and the Buick, the Patricians and Clippers bore strong family resemblances. So, in the early 1950s, Packard lost all of its shares of the luxury market. However, that loss was not made up with its entry in the midrange market.

So, Nance started to think about merging with another auto company to produce a giant that might transform the Big Three (GM, Ford, and Chrysler) into the Big Four. In 1954 Packard united with Studebaker to form Studebaker-Packard with Nance becoming chairman. In 1955 Studebaker-Packard turned out its new line of Packards. However, these new cars could not match the GM rivals in speed and acceleration and soon after the introduction the engines developed problems. Packard, once the symbol of integrity and superb engineering, was now known as a lemon. In July 1958, the last car rolled out of old Studebaker South Bend, Indiana, facility. Its passing was barely noticed.

One of the important lessons to be learned from the Packard failure was not that there was no room for an elite luxury car in the American automobile market, but that once lost, image and cachet cannot be regained; and once the magic associated with the marquee is gone, the aura of distinction evaporates. That is, the membership in the exclusive club of names that are synonymous with quality is generally difficult to acquire and to maintain. It includes such prestigious symbols as

Tiffany, Monte Blanc, Rolex, Chanel, and Fendi. There are more, but not many. As a matter of fact, in 1927 GM had been faced with a problem similar to that Packard went through; it needed to fill the price gap between Buick and Cadillac. At the time the temptation to produce a less expensive Cadillac had presented itself, but Alfred Sloan, GM's CEO, opted instead for a new nameplate, La Salle.

Also, most of the automobile companies initially concentrated on one or two products designed for a single market segment. Over time, some of these companies expanded into other parts of the market. For instance, to implement its strategy that there was a car for every purse and purpose, GM produced a wide variety of cars each with its own market and character, with many overlaps. While each car in the family looked different, they shared parts even bodies, and so were able to realize enormous economies of scale. As much as anything else, this was the key to GM's success. And the enormous economies of the GM scale explained why losses from Cadillac could have been well endured because Cadillac was a part of the huge General Motors operations; the red ink posted by Cadillac were more than enough compensated for by profits on Chevrolets.

Ford Company did similarly with the Ford going against the Chevy, the Lincoln against the Caddy. And Chrysler also made the effort, but while Plymouth could compete with Ford and Chevy, the Chrysler never achieved the status of the Lincoln and Cadillac. As for all other American car companies, they were mostly niche players, and over time all disappeared, in part because each had difficulties in defining its market, their sales would not permit the economies made possible by mass production, and the marketing power of the Big Three was too much to overcome.

Case Study 8.4 This example demonstrates by looking at the E. J. Korvette, a pioneer in discount retailing and marketing, that after entering the third stage of evolution, the marketplace is gradually saturated with a more-than-sufficient supply. As the revenue increases, the profit elasticity of the products and services starts to erode. So, due to the weakening profit margins (fewer materials can be sucked in from the black-hole side), further advances become slower and more difficult. At the end, the entire economic sector stops any attempt for further advancement. And the production stabilizes at the level of replacing aged and broken products purchased earlier. As a yoyo's spin becomes weaker, meaning that fewer materials are spit out (from the big-bang side) and sucked in (from the black-hole side), caused by appearances of other different but relevant new yoyos (economic sectors or companies), the yoyo might be absorbed by another faster and stronger spinning structure, or simply destroyed by several adjacent more energetic yoyos. This case study is based on (Sobel 1999a, pp. 27–44). For relevant details, analyses, and events, please consult with (Ferkauf 1977; Sobel 1999b).

Early in life while working in his father's luggage store, known as Rex Luggage, in midtown Manhattan, Eugene Ferkauf had large ambitions and heard of a luggage wholesaler who operated in lower Manhattan: at the same time when he sold luggage to retailers at the usual markup, the wholesaler also distributed his business cards, which contained a message offering a discount when presented at

his storage depot. The significance of this knowledge was that in 1931, Congress passed and President Roosevelt signed the Robinson–Patman Act, which was a new fair-trade provision that obligated retailers to charge prices fixed by the manufacturer. The main idea of the Act was to deny large retailers' advantages from discounts resulting from quantity purchases so that mom-and-pop operations would be able to survive competitions from large retailers that might cut prices in order to increase market share. In 1948 it was ruled that branded merchandise could not be sold below what the manufacturer wanted it to be sold for. Such was the situation Gene Ferkauf faced during the post WW II period. He knew not only of the Robinson–Patman Act, but also that now-forgotten luggage salesman who eluded the law during the later 1930s. Perhaps he could do the same.

For the summer of 1948, the economy was booming, as the anticipated post-World War II recession did not materialize. Along with the shortage of housing and the massive scale of construction in New York City, real estate property owners and renters were upgrading their household appliances. The market for large home appliances was larger than ever. Ferkauf took all this to heart and acted upon his instincts and knowledge. In June, Ferkauf opened his first "membership" E. J. Korvette store on 46th Street, not far from Fifth Avenue and Rockefeller Center. By making it a "membership store," Ferkauf got around the fair-trade laws. His approach was quite simple. The staff consisted of his friends and relatives, who now were salesmen, stock boys, and did anything else that required doing. Some of the salesmen would station themselves outside the store to hand out flyers listing the recommended selling price of selected items, along with Korvette's price, which was around a third lower than what was charged at the department or jewelry stores. Pedestrians taking the flyers were told E. J. Korvette was open only to members. The hawker would then hand a membership card to the questioner, who now was authorized to enter Korvette. Limited by the available space, major appliances Korvette would order from the manufacturer and let the distributor hold the stock and make deliveries with the customer paying on delivery.

In 1951 Ferkauf opened a second store, this one a short walk from United Nations headquarters. He reasoned that the closeness to transportation and the 42nd Street crowds would bring in one kind of clientele, while UN workers would mob the place during lunch hours to get appliances and other wares to send home to consumer-products hungry relatives and friends overseas. The idea worked; and there were long lines outside the store from 11:00 am to 2:00 pm. A third store was opened on the 48th Street in 1954, soon followed by the fourth in a store front in suburban White Plains; the fifth was opposite the Rockefeller Center skating rink, the six an abandoned supermarket in Hempstead, New York. All were discount operations and all sold the same kind of merchandise as in that first store.

As expected from the systemic yoyo model analysis and the First Law on State of Motion, with his different kinds of operations, Ferkauf had running constant battles with department stores and in some cases manufacturers. In this time period E. J. Korvette did not put out any advertisement. However, the New York newspapers carried stories of legal actions brought against Korvette by various

stores, such as Macy's, due to Ferkauf's low-price policy. Readers learned of the store in such indirect way and rushed to make their purchases. By 1956 there had been 35 fair-trade lawsuits filed against Korvette. Most either were dismissed or dropped. Also, fortunately to Ferkauf, the Robison-Patman Act was repealed in time so that by then discounting became a way of life.

Along with Korvette's exponential growth, some conventional problems associated with rapid growth, such as prospects, personnel, financing, site location, and scores of other problems, surfaced. For the matter of personnel, in 1954, Ferkauf started hiring part-time and soon full-time workers. These new people lacked the dedication of the old timers, and many found it difficult to stand the fast pace of operation. Also, Ferkauf's reliance upon personal relationships proved troublesome, as the old and new hires resend one another, creating divisions and inviting bitterness and charges of favoritism. And for the matter of financing, the rapid expansion had strained the treasury. Pushing these problems into the backburner, Ferkauf decided the next step was to expand into new and unfamiliar lines of merchandise, his attempt to transform E. J. Korvette into a promotional department store chain. In late 1955 Ferkauf erected his first department store, named Korvette City, with the construction work rushed in order to open in time for the Christmas season. The store was a huge success. This new promotional department store was different of the Korvette's older discount houses, and it even had a food market, run at a loss, to attract customer. That was the year Korvette sold its initial stock at $10 a share so that Ferkauf had additional funds for expansion. Within a year the stock stood at 22.

By purchasing 42% of privately owned Alexander's for $9.7 million, Ferkauf entered the retailing of soft goods. At the same time Ferkauf opened new stores at a rapid pace, one every other month for a period of time, while quietly he closed those six small discount stores. So now Korvette was wholly in the department store business. While the personnel were stretched thin, Korvette's revenues rose from $17.8 million in 1954 to $54.8 million in 1956 and then went over $100 million in 1958, by which time Korvette had 12 stores.

In 1964 Jack Schwadron was named president and chief operating officer. While when he was at Alexander's as the manager of fashion business over three years ago, he had attempted to win approval for a move into high fashion that would lead the company into competition with best Fifth Avenue stores. However, he failed. Not giving up his ideas, now he painted the similar picture for Ferkauf: Korvette could sell jeans to students and also fur coats to society matrons. In 1962 Korvette opened a store on 47th Street and Fifth Avenue within walking distance of some of the world's most upscale stores. This store did well. It sold upscale items at discount prices. And Korvette stock responded. Adjusted for a 3-1 split in late 1961, it sold for close to 170 in the summer of 1962. Riding along with the success, there were even plans for making a big splash in California and taking the Korvette idea to the United Kingdom and new kinds of specialty store. Ferkauf was ambitious. "All I want for this company is that it should do all the merchandising business in the United States," he once remarked. Even so, familiar problems soon developed with this store. The merchandise might be upscale, but

the place itself soon became shabby. Within a few years the carpets were stained, the paint faded, and elevators creaky. By 1965 those customers, having had walked in the Fifth Avenue store with Bonwit Teller, Lord & Taylor, or Henri Bendel bags, disappeared; suburban customers and those from the outer boroughs no longer trek to Manhattan to get bargains that they might conveniently find locally.

In terms of performance, Korvette suffered from nagging problems. Revenues were rising steadily, over $500 million in 1965. But profits were only a meager $17 million. What was the purpose of being big if no profits could be generated? The food business was a loser. Ferkauf's art gallery located in Douglaston, Queens, where paintings selling for more than $50,000 were displayed, never made money. Soft goods accounted for 40% of sales with clothing being most of that. Schwadron had not been able to work miracles there; and Ferkauf still did not find such a person who knew how to bring profits out of that business. Additionally, his furniture lessee, H. L. Klion, went belly-up, which forced Ferkauf into another business he knew little about. Impulsively, he purchased Federal Carpet, yet another unfamiliar area. In February 1965, Korvette purchased Hill's Supermarkets, a Long Island-based operation. Three months later its CEO, Hilliard J. Coan became chairman, with Schwadron moving to the presidency and Ferkauf to the chairmanship of the executive committee. With this change in power, Ferkauf ceased exercising day-to-day control of Korvette.

Coan brought a sense of order to Korvette, plugging losses, computerizing operations, and attempting to rein in some of Ferkauf's expansion plans. With expanding sales, it appeared that Korvette would be a billion-dollar corporation by the end of the 1960s. The chain had grown to 45 stores in nine metropolitan areas. In 1966 Ferkaus initiated merger talks with Charles Bassine, an apparel manufacturer, who also operated Spartan Industries, which among many other holdings had Spartan-Atlantic discount store. And in September Korvette was folded into Spartan, whereupon Coan left the company with Ferkauf joining the Spartan board without any managerial authority at the stores he had founded. Now in control, Bassine brought tighter management to Korvette. He closed the supermarkets, sold off other units, as well as the stake in Alexander's. During the next few years the out of town stores faltered. Bassine moved farther from the discount image and tried to compete with Macy's and other conventional retailers, while losing their bargain hunting customers. Troubled by business and domestic problems, in 1970, Bassine merged with Arlen Realty & Development, a firm that had constructed some of the Korvette stores. Arlen was controlled by Bassine's son-in-law, Arthur Cohen, who had no background in retailing. Cohen closed the furniture departments and instituted further economies. However, through his tenure he seemed far more interested in erecting shopping centers than in running the chain. In this period of time, Ferkauf sold most of his Korvette shares.

In the 1970s, more departments were closed with furniture and carpets gone in 1972. In 1973, on sales of $606 million, profits were merely $8 million. Then, in 1974, Arlen lost $22 million and $60 million the following year. In 1977 Korvette reported revenues of $590 million and a loss of $4 million. The loss continued. Cohen was shopping Korvette to potential buyers. In April 1979 the French firm of

Agache-Willot, which operated department store and clothing factories, purchased 51% of Korvette for $31 million. Agache-Willot instituted a program of cost-cutting, slashing employment to the bone. Even so, sales continued to fall with mounting losses. The company finally closed its stores in December 1980, after a disappointing holiday season.

The main reason for Korvette's failure was not that Ferkaus did not have the necessary imagination or vision. However, he was unable to integrate his ideas into a cohesive strategy. In terms of the systemic yoyo model, Ferkaus had the foresight to see the need of the society and the gut to make things moving. However, he could not successfully form his economic yoyo with enough strength of rotation. Using the terms of the management, this end implies that after Ferkaus officially formed Korvette, he was unable to establish the necessary management team (the narrow neck of the yoyo structure of his company), the needed financial policies (the specific ways materials are either sucked into or spit out of the yoyo structure), and formulate careful designed strategic expansion by considering the characteristics of the yoyo structure of his company. The reason why none of these had been a problem when Korvette was a discount chain is because at that time the company was still a subeddy existing in the discontinuous zone of several large and powerful retail eddies. As soon as the company started to have its identity, it became clear that it did not have any long-term goal. This end is vividly shown by the fact that its leaders, from Ferkaus on down, could not decide what they wanted the company to be.

To support this analysis, we can easily look at a case of another company that did it right. For instance, Krege became a discounter in 1962, the year Korvette opened the Fifth Avenue store that marked its change of direction. And as noted, there were many store chains that were imitating the Korvette's approach. The new company, renamed Kmart, did not appear more promising than most others. Like Korvette, Kmart also expanded rapidly; however, its focus was always clear, its strategies carefully planned and worked out, and its financing in place. There was an excellent trainee program, whereby Krege managers were recycled and inculcated with the concepts required for success in discount department stores. At first when cameras, sporting goods, jewelry, and men's clothing were leased, Kmart personnel could watch and learn before these products were included in its retail list. Most importantly, these discount store chains could have learned from Krovette's blinders in achieving their successes.

Case Study 8.5 By looking over the history of business successes and failures, it can be seen that with some minor variations each real-life economic entity goes through the following three-staged lifespan, as theoretically analyzed above and demonstrated in the previous paragraphs with case studies:

1. When several spinning yoyos co-exist side-by-side, as shown in Fig. 8.2, their mutual interactions lead to appearance of new products and new services, which are the symbolic subeddies in Fig. 8.2; and to cash in on the profit opportunities coming along with the new products and services, a new industry and new business enterprises are born.

2. In the second stage of evolution, trend-following companies start to pop up at a high speed, similar to the situation that when a calm pond of water is initially disturbed, instead of a big whirlpool is created, many areas of the water start to move. As a consequence, the relevant investment in terms of capital and human resources is drastically increased and the production level is brought up to a higher level.
3. In the third stage of evolution, the marketplace is gradually saturated with a more-than-sufficient supply. As the revenue increases, the profit elasticity of the products and services starts to erode. So, due to the weakening profit margins, further advances become slower and more difficult. At the end, the entire economic sector stops any attempt for further advancement. And the production stabilizes at the level of replacing aged and broken products purchased earlier. As a yoyo's spin become weaker, caused by appearances of other different but relevant new yoyos (economic sectors or companies), the yoyo might be absorbed by another faster and stronger spinning structure, or simply destroyed by several adjacent more energetic yoyos.

According to the systemic yoyo model where the business world is analogous to an ocean of spinning yoyos, one can easily see that any company or product that superbly suited for a specific time, place, and function may prove deficient when the passage of time and unanticipated developments alter the existing situation and business environment. That is, with the passage of time, the equilibrium of forces between rotational yoyo fields is always dynamic; one state or form of equilibrium in general does not last very long before it evolves into another state or form of balance. That explains why once superb products or forms of organization may become harmful or inappropriate; and when a fine product, service, or even company falls of its own weight, and there is little management can do to rectify the situation. Similarly, the CEO who was ideal for a period of growth may falter when retrenchment is demanded. A financially oriented leader may do poorly when technological expertise is required. Wise boards understand this. When the current CEO departs, the members assess the company's probable needs and only then make their selection for a successor. If due to changes in the business climate the CEO does not fill the bill, they purposely ease him out. For example, Pan Am's CEOs, who used to perform splendidly in the environment of strict regulations, in the 1970s, 1980s, and 1990s were unable to come to terms with a new dispensation. Once Keuffell and Esser produced the best slide rulers in the world. In came the pocket calculator, out went the slide rule, and Keuffell and Esser was gone as well. Management saw it coming, knew the company was doomed, and simply gave up. The seventh largest American corporation in 1909 was Central Leather, the leading supplier of industrial belting to factories, where leather straps were used to transmit steam power from the generator to the assembly lines. The factories electrified in the 1920s, and Central Leather was shuttered by the end of the decade. In the early 1960s Republic Steel saw a key customer, the canning industry, turn to the aluminum version, while foreign manufacturers were eroding its other markets. Management appeared paralyzed. At a time when several

aluminum companies might have been purchased at reasonable prices, the CEOs spoke of aluminum as the weak metal, adding Republic would never give up on steel. Today Republic is no more, doomed by unimaginative and timid leaders.

Because the state of equilibrium in the dynamic ocean of economic yoyo fields evolves, one natural question will be: what might these companies have done? For Keuffell and Esser, it had a skilled labor force and a staff of top-notch designers. Entry into the instrumentation field would not have been impossible. For Central Leather, it owned forests (from which to extract tannin), glue works, and had several factories at which chemicals were manufactured. The sales force was among the tops in its field, and the balance sheet strong. Since to remain in the leather business made no sense at all, Central Leather might have well stressed forest products or adhesives, or found some other outlet for its assets. The failure of this company indicated that an obvious lack of imagination and paralysis of will at the top management level.

The next natural question is: can an existing corporation redirect its focus and reorganize its business operations? The answer is Yes, many American companies had done it, some did it several times. For instance, in 1909 Pullman was the eighth-largest American industrial corporation. There was a time when it was virtually alone as a manufacturer and leaser of railroad sleeping car. And then in came the airplane, the passenger railroads declined, and Pullman suffered sale losses. The management saw what was coming and made adjustments. Even before placement of sleeping cars declined it expanded into freight carriers. During World War II Pullman purchased M. W. Kellogg and expanded into plant-and-process engineering for the oil and chemical industries. Then it acquired Trailmobile and became a major factor in truck trailers. Today little is left of the old Pullman. A second example is the W. R. Grace that Peter Grace bequeathed to his successor was completely different from the one he had inherited. As a matter of fact, the decline and fall of a once-proud product or company results frequently from the business blunders of managements that are frozen in time and/or space, unable to adjust intelligently to the changing environment. Feeling safe in their niches, secure in their market shares, managements are blindsided by new technologies and customers.

To make the discussion of this section more vividly colorful, let us now demonstrate how a company actually went through the three stages of evolution by looking at a relatively detailed account of the development trajectory of Montgomery Ward. This presentation is based on (Sobel 1999a, pp. 239–258). For relevant details and events, please consult with (Balu 1997; Berner 1997; Berss 1994; Hoge 1988; Latham 1972; Steinhauer 1997).

Since the late nineteenth century, Montgomery Ward and Sears Roebuck had dominated the mail-order business in the United States. After WW I both companies suffered through a sharp though short depression of the kind that often followed cutbacks in military spending. After 1921 along with the economic recovery, Montgomery Ward expanded exponentially under the leadership of CEO Theodore Merseles and his second in command Robert Wood. Merseles, who had come up the corporate ladder in mail order, was convinced he could pass his rival

Sears Roebuck in a decade. On the other hand, recognizing the prevalent booming mail-order business, Wood foresaw it as a relic of rural America that was bound to decline as farmers in their Model Ts came to the cities to shop. In 1921 he predicted that the future of the industry rested in retail department stores, not in mail order. With Montgomery Ward's franchise name and reputation, Wood wanted to establish stores in and around large cities. However, Merseles rejected the idea.

Understanding the merit in Wood's market perspective and hoping to snare an outstanding leader, Julius Rosenwald of Sears Roebuck approached Wood with the offer of the top operational position there. Infuriated on learning the offer, Merseles fired Wood; and without much choice Wood promptly accepted the Sears offer and dreamed about implementing his strategies. Once at Sears, Wood started putting up those imagined stores along with other necessary steps. Enamored as he was with the automobile, he also founded Allstate as a wholly owned subsidiary to insure them. Seeing the successes of the Sears stores and recognizing his error, Merseles modified his position and opened the first Montgomery Ward store two years later. This was not to be a department store, but rather a showcase for catalog goods. However, to his surprise, Merseles discovered that customers did not want to purchase those goods from catalogs, but rather from inventory. Somewhat reluctantly he gave in. Montgomery Ward had ten stores in 1926, which rose to 248 in 1928 and on to 554 in 1930. With the proven successes of the stores, Merseles still considered himself a mail-order merchant, although he was sufficiently flexible not to fight against the trend. Starting in 1930, the Great Depression crippled retailing and the company was deep in red ink. However, along with the mounting losses at the existing stores, the optimistic Merseles continued opening stores in 1931, Montgomery Ward common, which sold as high as 157 in 1929, was less than 7 in late 1931. Finally, J. P. Morgan & Co., Montgomery Ward's banker, replaced Merseles with Sewell Avery in November 1931. As US Gypsum's CEO from 1905 on, Avery had been a capable and imaginative leader, especially when it came to cutting costs. While other companies that produced materials used in construction suffered during the economic falloffs that came with the end of the WW I, Gypsum did very well. There were several minor slumps in the 1920s, during which Avery pushed Gypsum into new markets and increased its share of the business. So, it was sufficiently shown that if anyone could manage in bad times it was Sewell Avery.

Avery, who was then 54 years old, tackled the task with verve and intelligence, which made up for his lack of experience in retailing. On the basis of his past successes and the newly established ones at Montgomery Ward, Avery dominated the board (for how a CEO could achieve this end in general, please consult with the discussions in Chap. 10). For the stakeholders of Montgomery Ward, the selection of Avery at that particularly difficult time was fortuitous because during the Great Depression Avery proved as good if not better a manager as Wood. Among many things Avery did, he introduced efficiencies, upgraded the merchandise, and refurbished the stores. Avery closed almost 100 old stores and opened nearly twice as many new ones at much better locations. Recognizing that

the mail-order mentality still existed at the various stores that were constructed prior to his arrival, Avery brought in new managers who were rewarded on the basis of performance. In 1934 Montgomery Ward reported a profit of $2 million, followed by one of $9 million in 1935. The dividend, omitted in the beginning of the Great Depression, was restored in 1936. In 1939 when it appeared the Great Depression was ending, Avery started building new stores in selective downtown areas.

As the WW II approached, Avery predicted that further expansion would not be possible or even desirable in the kind of economy the war would bring, while believing that the war would take the nation out of the economic doldrums, but the demands of the military would imply peacetime goods would not be produced. Furthermore, he predicted that when the war ended there would be massive dislocation and return to the Great Depression atmosphere of the 1930s because that had been the reaction after the Great War. With this strong conviction in mind Avery designed a strategy for the postwar period by not expanding but retrenching. Hence, Montgomery Ward stopped opening new stores in 1941. From having learned the lessons of prudence in 1921 and then again in 1931, he was prepared to await that anticipated economic slowdown before undertaking expansion. Avery was determined to keep Montgomery Ward in the same superb financial condition as it just came out of the Great Depression through the anticipated postwar economic slowdown.

However, there was no new economic crisis. Although postwar government purchases declined by a sum equal to one quarter of the GDP, this did not cause the economy to return to the Depression levels. Indeed, there was unemployment, as the military released its personnel back into the workforce. For instance, in 1944 there had been 670,000 reported unemployed workers, which rose to slightly more than one million in 1945 and then leaped to 2.3 million in 1946. The figure kept rising, peaking at 3.6 million in 1949 before declining. But, that was still far off the experts' prediction of 8.9 million. The reasonably harmonious economic conversion was resulted from a postwar outburst of demand. This led to inflation as wartime wage-and-price controls were lightened and consumers rushed to purchase those goods they had gone without during the Great Depression and the war, paying for them with savings from their wartime jobs. Avery took note of this and believed this was a bubble that would be followed by a crash. Furthermore, his belief was supported by Geoffrey Moore, a distinguished business-cycle theorist. Moore also noted startling similarity between credit growth in the 1920s and what occurred in the post WW II period, leading to the conclusion that a bust was in the making.

Along with his identification of the signs of prosperity in the economy as a huge bubble in the making, Avery accelerated his hoarding of capital, which inevitably starved the normal operations of Montgomery Ward. On the other hand, Wood set out on the biggest gamble of his career, as he so commented. During the period from 1945 to 1954, as Avery added to his pile of cash and securities, Sears invested $300 million in more than 100 new stores and support systems. For Montgomery Ward, its large paint factory, its fence factory, warehouses, and other

operations were deprived of capital for any expansion. From the end of WW II to 1957, Montgomery Ward's sales dropped from the level of 58% of those of Sears to less than 29%. Also, due to the explosion of consumer spending, during the immediate postwar period from 1946 to 1948, Montgomery Ward's revenues rose from $974 million to $1.2 billion, while earnings advanced from $6.3 a share to $10.28 a share. However, the price of Montgomery common fell almost 50%. On the other hand, Sears's earnings went from $4.18 to $5.70 per share with its stock traded in a narrow range in the 1950s. This fact clearly implied that the investing public clearly preferred Wood's approach to Avery's.

While there was a coup attempting at retiring Avery in 1948, who was 74 years old, at the headquarters of Montgomery Ward, challenges from the marketplace were appearing hot and heavy. Discount operations such as E. J. Korvette were making their indents so that both Sears and Montgomery Ward were forced to slash their prices to remain competitive. And suburbia was becoming the new center of American life; Sears responded by erecting stores there, while Montgomery Ward proceeded with its predetermined plan developed on Avery's single-minded quest for liquidity. By then it had become apparent to those who worked with him that Avery had lost his touch of the reality. In 1955 revenues of Montgomery Ward dwindled to $970 million and earnings to $35.4 million, or $5.22 per share, most of which were kept in the bank. In 1949 the liquid assets had amounted to $87 million, and in 1955 it was more than $320 million. Current assets that year were $690 million against current liabilities of only $82 million.

In 1955 Louis Wolfson attempted a hostile takeover bid on Montgomery Ward. Wolfson was the most flamboyant businessperson of the mid-1950s. He amassed his fortune by purchasing surplus shipyards and other properties at distress prices, selling off portions, using his profits to purchase other similarly underpriced assets and repeating the operation. In 1954, Wolfson was CEO of Merritt-Chapman-Scott, a major shipbuilder, and Capital Transit, which operated the Washington, D. C., transportation system. He also had a collection of other interests. Wolfson by then had targeted Montgomery Ward, which he hoped to take over in a proxy contest and to unlock the assets Avery had permitted to dwindle. In early that year, Wolfson and his associates gathered and studied information about Montgomery Ward and its competitors. The more they looked into the details, the more attractive Montgomery Ward appeared and the more likely it seemed a raid would succeed. And it became clear that no matter what happened to his takeover bid, Wolfson could not lose.

For Montgomery Ward, its stock's average ratio of price to earnings (P/E) of the previous year had been less than 10, indicating how out of favor the shares had become; and the company had $50 a share in cash and securities alone. Armed with this knowledge, Wolfson started accumulating share of Montgomery Ward common, which was selling in the 1940s down from the peak of 104 in 1946. And what was central to the Wolfson campaign was the assertion that Avery had permitted Montgomery Ward to stagnate while other retailers expanded vigorously and successfully; if Avery truly believed he was doing so fine a job, how could he explain the fact that management owned very few shares in the company? If he

won the contest, Wolfson would make managers be owners. Wolfson correctly predicted that even if he lost the takeover bid, the management might be forced to carry out parts of his program that would inevitably bolster shareholder values. At the same time, the price of Montgomery Ward common rose immediately after Wolfson made his announcement, and by December was selling at close to 80 for the following clear reason. Share prices were expected to rise during the struggle for control, after which speculators would sell. This often happened in such circumstances and did not necessarily favor one side or the other.

To prevent Wolfson from achieving success, the management of Montgomery Ward took account of some of his recommendations. In particular, Avery raised the quarterly dividend from 50 cents to 75 cents and declared a year-end extra payout of $1.75. The board indicated that anything Wolfson planned to do for the company could be done by the current management. And the shareholders were told that Wolfson was an adventurer who if given the chance would squeeze their company dry. Other CEOs from across the nation also joined in the attack, fearing that a Wolfson success would encourage raiders like him to take a look at their companies. Because Wolfson was unable to persuade small shareholders, who held the balance of power, of his abilities to run what many still considered part of their family, and so long as shareholders received their dividend checks and the price of their holdings did not decline significantly, they supported the management—their management, as shareholders of the time tended to think. At the end, Wolfson only received 31% of the ballots, which under the Montgomery Ward bylaws entitled his team to three board seats. Wolfson and two lieutenants joined the board. And capturing the opportunity two other board members indicated that they might vote with Wolfson's team if Avery insisted on remaining at the helm. Both Avery and the president Edmund Krider resigned soon after. The news caused the price of Montgomery Ward's stock to rise five points.

The board then turned the company over to John Barr, a veteran of over 20 years of Montgomery Ward without any experience in retailing. Under Barr's leadership, Montgomery Ward's common was split two for one, and the dividend increased. Barr strove mightily to turn the company around. However, in spite of the better performance and positive news stories, absent the proxy fight the price of Montgomery Ward shares fell. So, did earnings, which never again reached their 1953 level. The company was in trouble. Barr still lacked the kind of quality personnel that directed Sears and J. C. Penny. So, he sought talent through merger. However, instead of a merger, in 1961 Tom Brooker, an engineer and production man without any experience in retailing, became president, and four years later took over as chairman as well. By then Montgomery Ward's cash position was down to $31 million from that of $320 million in 1955. Debt-free during the Avery years, Montgomery Ward now had to consider floating a large bond issue in order to continue its expansion program.

Without a clear mission, in 1966 Brooker purchased Pioneer Trust $ Savings; the next year he acquired Hydro Conduit Co., a small concrete water-pipe business; and then he established the Montgomery Ward Life Insurance Co. Given the characteristics of the age, several conglomerateurs cast their eyes on Montgomery

Ward—given the price of the stock, the company could easily be taken over; and then if no recovery took place, it could be carved up and sold off piecemeal, or offered to another retailer as a merger possibility. To this end, one thing was fairly certain: Montgomery Ward would either die a lingering death or disappear in some other fashion. Realizing this, Brooker started casting about for a merger. In 1967 discussions began between Montgomery Ward (revenues of $1.9 billion with earnings of $17 million) and Container Corporation of America, the largest cardboard container company in the world whose sales were $463 million and whose earnings were $33 million. However, the merged company, called Marcor, resulted more from the vagaries of the federal tax code than from hopes for a good business fit. Brooker became the chairman, Leo Schoenhofen of Container Corp. the chief operating officer with the latter being the dominant figure. Under the new leadership, by 1972 both ends of Marcor were doing well.

The Organization of Petroleum Exporting Countries boosted the price of oil in 1973, leading not only to higher profits for those companies with large reserves, but also to uncertainty as to what might happen next. This uncertainty prompted the oil giants to search for diversification. So, Mobil purchased 5% interest in Marcor, and later in the year it made another purchase of 51% of the shares. In an overheating economy Marcor looked quite attractive, so in 1976 Mobil purchased the rest of the company.

Even with large cash infusions from Mobil, Montgomery Ward stores seemed dowdy, as though out of another era. In the mid-1980s the company tried to redesign itself as a collection of specialty shops, including the likes of Rooms & More, Home Ideas, Gold 'N' Gems, Auto Express, and Electric Avenue. This led to a short-lived revival. By then Mobil was searching for a way out, having forgiven $500 million of the loans to its ailing subsidiary. In 1988 Montgomery Ward's management availed itself of takeover artists, who, funded by Drexel Burnham Lambert and enthusiastic supported by Mobil, engineered a $3.8 billion leveraged buyout with the participation of General Electric Capital, which received half of the ownership for $180 million. GE Capital infused additional funds in an amount between $300 and $900 million into Montgomery Ward. It did not do any good. In summer 1997 Montgomery Ward's suppliers started complaining about the late payments of bills. The company filed for Chap. 11 bankruptcy protection on July 7, 1997. However, the court protection proved to be not much use. The company was really finished.

8.4 Some Remarks

What are obtained in this chapter indicate that the research of economics, organizational behaviors, and management mainly involves nonlinear analysis of economic forces in terms of calculus-based mathematics, evolutions of structures internal to individual business entities in terms of the physics of materials, and the dynamics of structural equilibria in terms of the interactions of spinning yoyo

fields. This work provides a theoretical explanation for why each economic sector or business firm possesses a form of life and goes through such stages of evolution as birth, growth, maturity, and death.

In particular, this work shows that the characteristics of the board determine the fate of the firm because the board stands for the core or the overall spinning strength of the economic yoyo structure of the firm. When the board no longer has the will power for the firm to grow, no matter how capable the CEO is, the firm will be all but finished.

Chapter 9
Economic Eddies and Their Dynamic Equilibrium

Continuing the presentation in the previous chapter, in what follows we will model in Sect. 9.1 each commercial firm as a specific, abstract spinning yoyo, referred to as an economic yoyo. Then, on the basis of the evolution of a flow of such yoyos, we can see how these economic yoyos interact with each other through combinations and breaking-ups. This end shows why there exist companies of different sizes in each economic sector or industry. Similar analysis shows why at any chosen moment of time in history, there are economic sectors and industries of various scales. In particular, we employ figurative analysis and relevant methodology to show how small economic entities could be inevitably bullied and destroyed by business empires.

With such a dynamic systemic analysis, which points to certain key structures for each existing commercial entity, such as a firm, an economic sector or industry, in place, we establish in Sect. 9.2 a traditional calculus-based profit-maximization model to study large and small firms and their difference in areas of production, determination of product selling prices, and the cost basis of their products. Among what we find is that when a firm has limited resources, its business has a glass ceiling for its potential maximum level of profits. Such a ceiling over the potential level of profits does not exist for firms that have unlimited financial resources.

Then, in the name of investigating interindustry wage structures, we show in Sect. 9.3 that other than the difference in the area of profit potentials, the availability of financial resources determines how small firms might manage their day-to-day operations and how few other related resources are available to them. Specifically to this end, it is worth mentioning that in the past half a century, many first class economists, including Nobel Laureates George Stigler of 1982 (Stigler 1958), Robert Solow of 1987 (Solow 1979), George Akerlof of 2001, and Daniel Kahneman of 2002 (Kahneman et al. 1986), have contributed to the understanding of interindustry wage pattern. However, as Thaler (1989) shows, none of the established attempts seems to explain the existing pattern in a satisfactorily

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manner without assuming something difficult to accept. To this end, the presentation in this chapter provides the most intuitive and plausible explanation without assuming anything difficult to swallow.

To support many of the conclusions obtained in the first three sections, in Sect. 9.4 we look at several thought-provoking case studies. The first case study shows that when the equilibrium of forces in the market place, the temporary balance of power in the ocean of economic yoyos, changes, each company has to modify its internal structure; otherwise, the company, no matter how successful it was, would fail. In particular, in this case, we look at how changes in the government role in assisting business affect the livelihood of all relevant firms. Historically, governments were instrumental in the development of transportation and communication, ranging from the operation of the postal service, assistance to the merchant marine, and the creation of canals and rail roads to space programs and the development of the Internet. The Federal Highway Program alone has cost more money than what was expended in the recovery program during the Great Depression. The hue defense program, the basis of the military-industrial complex, has been one of the striking examples of government's role in the economy. The government presence generally takes one or more of several forms. Subsidies, land grants, the provision of desired services at nominal or no costs, protection against foreign competition, and regulation are some of the leading ways governments help or control industries.

The second case study analyzes the development history of Radio Corporation of America in order to show that when a viable economic yoyo stops its rotation, it will cease to exist and its parts will be taken by other spinning fields. In the business arena, when a leader is pressured to compete with the real or imagined accomplishments of his parents, the child tends to freeze in time so that his business correspondingly stops evolving along with the changing environment. For example, Adolph Zukor founded Paramount and Albert Einstein was arguably the greatest scientific mind of the twentieth century. Their sons, Eugene Zukor and Hans Einstein, will not be found in history books. John Patterson founded National Cash Register and dominated his firm, the industry. When John Patterson died Frederick, his son, had to make the kinds of decisions that would enable NCR to retina its lead in business machines, and this was beyond his abilities. He was incapable of action, as though fearful of disappointing the ghost of his departed father. Similar situation occurred to Bobby Sarnoff. From his father, David, he had inherited Radio Company of America, a vital company with strong positions in broadcasting, manufacturing, and recording, among other things, and a major new foray into computers. However, Bobby transformed such a superb electronics concern into a slapdash conglomerate in less than a decade that RCA no longer exists today.

The third case study shows how small yoyos are bullied or destroyed by larger systemic fields, as depicted visually and analyzed figuratively in Sect. 9.1. Historically, new industries are saturated by amateurs and mature ones are populated with professionals. For instance, the first railroaders did not know the shape, size, and configuration of a locomotive. The Wright brothers had to figure out how airplanes should look like and how they were to be powered. Adam Osborne was daring in making in his foray into territory IBM and others avoided, and he had to

imagine the shape and purpose of the first transportable computer. Gene Ferkauf had to make a leap of imagination to develop the discount store. The succeeding generations also have to experiment and innovate, but their object is to develop and produce a superior version of something that existed at a competitive price. That is why new industries generally attract entrepreneurs and older ones managers. After having been successful in all of his business ventures, Henry J. Kaiser, a legend of the business world of his time, after World War II, decided to the established automobile industry. That industry had already been commanded by other, experienced companies led by people who know the territory. To him, automobiles were just another business to conquer. He had done it many times in other fields. Why not this one? As it turned out, the established empires of the automobile industry was too much for him to shake. Instead, he was bullied and torn up into pieces by the empires.

The fourth case study presents a story of success, where we will learn the fact that it is possible for an economic yoyo field to evolve along with the changing environment. In this study, we will see how Peter Grace successfully developed W. R. Grace, a well-known company established by his grandfather, William Russell Grace, and he inherited from his father, Joseph Grace, into a well rounded conglomerate. Just like Harold Geneen, who took over at ITT, and after attempting to revamp it, transformed the company into a conglomerate.

The fifth case study shows what could happen when two opposite polarities of yoyo fields attract each other while the directions of fields' rotation do not match by looking at the disappearance of the Penn Central in the year of 1970. In particular, what may appear a sensible match in abstract terms often turns out to be a nightmare when actually undertaken. There are problems of melding different corporate cultures and eliminating redundancies. Since what are involved are human organizations, some of the most difficult hurdles are definitely human: who gets what under the new dispensation, who reports to who, and even the location of the headquarters. When the Pennsylvania and New York Central Railroads came together in 1968, no care was taken to orchestrate the marriage and harmonize matters. Besides, historically, the two companies had long been rivals, contesting for business in the Midwest. Neither brought to the table anything that the other needed. The promised economies for the combined organization never materialized. Top managements scorned each other. Finally, government intruded, making it impossible.

This chapter is concluded with some final remarks in Sect. 9.5.

9.1 Economies: Seen as Oceans of Interacting Spinning Yoyo Fields

Let us identify each commercial company as a spinning yoyo as in Fig. 9.1, where the black-hole side sucks in all the basic supplies to sustain the vitality of the company, such as the needed raw materials, utilities, human resources, various services, and most importantly, the profit or monetary input. The big-bang side

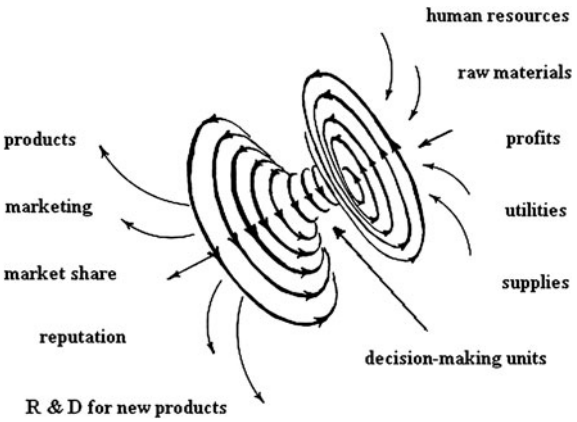

Fig. 9.1 The yoyo model for a viable commercial company

emits the company's products or services. Through marketing effort, the company establishes its reputation for quality and occupies a certain percentage of the consumers' market. According to the discussions on the stages of evolution of economic entities given in the previous chapter, in order to fight off the copycats in the marketplace, the company continually eyes on potential expansions in new areas of business with the help of its R & D efforts. Without expansions, the originally, seemingly secure market share will gradually dry up by the aggressive copycats and by newer and better products provided by other companies. And, within the company, various decision-making units, including the board of directors, the CEO and other executives, etc., connect the two sides of the spinning yoyo (Gillan 2006).

Because in general the fundamental mechanism for a yoyo structure to rotate is the uneven internal structure of the organizational or physical entity, where the uneven structure could be either innate or caused by some outside force (OuYang et al. 2001), it can be seen that the force necessary for any economic yoyo to exist is a continued inflow of money in terms of either profits or infusion of cash or both at and above the minimum sustainable level. (For this end, see Case Study 9.1 in Sect. 9.4, where a historical account of Pan Am, once America's flag airliner, is given to show how when the equilibrium of forces in the market place changes, the temporary balance of power in the ocean of economic yoyos, each company (an individual economic yoyo) has to modify its internal structure; otherwise, the company, no matter how successful it was, would fail.) Without such infusions of cash or a (potential) ability to generate the adequate inflow of profits, the company will fail and its economic yoyo will stop its rotation so that its parts will be taken by other economic entities (yoyos). For this end, please consult with Case Study 9.2 in Sect. 9.4, where the development of Radio Corporation of America is analyzed to show that when a viable economic yoyo stops its rotation, it will cease to exist and its parts will be taken by other spinning fields.

Following the introduction of an innovative idea or the successful manufacturing of a new product, along with the opportunity for obtaining fame and making

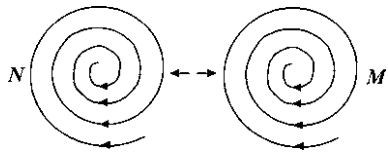

Fig. 9.2 Interacting convergent harmonic yoyo fields

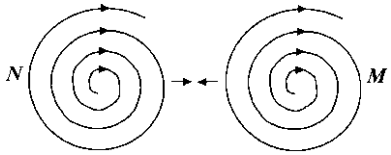

Fig. 9.3 The divergent sides of the interacting fields *N* and *M*

profit many entrepreneurs will enter the same sector of the economic actions to fight for their shares of the potential profits. That is how an industry or an economic sector starts to emerge. Now, let us imagine all the possible spinning yoyos, each of which stands for a company, of an industry, floating against each other. Then we can readily see the fact that some yoyos will have the tendency to combine into greater yoyos and some other yoyos may break into smaller yoyos or simply disappear, depending on the yoyos' spinning directions, speeds, and the angles of tilt. For instance, let us look at two convergent harmonic yoyo fields as shown in Fig. 9.2. These two yoyo structures form a two-body system, which is similar to the binary-star systems as observed in astronomy (Lin 2007). In particular, the two convergent fields *N* and *M* tend to attract each other to form a giant spinning pool. However, when these two fields move too close to each other, their divergent fields on the other sides of the yoyo structures will start to repel each other (Fig. 9.3). And when they are far from each other, their convergent sides will start to pull each other together. So, these two spin whirlpools form a giant rotational field, within which the harmonically spin yoyos rotate about of each other.

Now, let us see how a much smaller yoyo structure *m* would survive the interaction between the two relatively greater yoyos *N* and *M* as shown in Figs. 9.2 and 9.3. In Fig. 9.4, all yoyo structures are shown to comply with the left-hand rule:

Left-hand Rule: If the figures of the left-hand curve along the direction of spin of the eddy field, then the thumb will point to the direction along which materials are absorbed into and giving off from the narrow neck of the systemic yoyo.

In reality, the general systemic yoyo field does not have to follow this left-hand rule. This fact makes the study of realistic systems more challenging.

For Fig. 9.4a, small yoyo *m* will be pushed upward by the meridian fields of *N* and *M* along the direction of X → Y. If the meridian field Y of *N* is much stronger than that of *M*, then the majority of the yoyo structure of *m* will be pulled into the field of *N*. On the other hand, if the meridian field of *M* is much stronger, then the majority of the yoyo structure of *m* will be pulled into the field of *M*. If the meridian fields Y of both *N* and *M* are roughly the same strength, then the existing

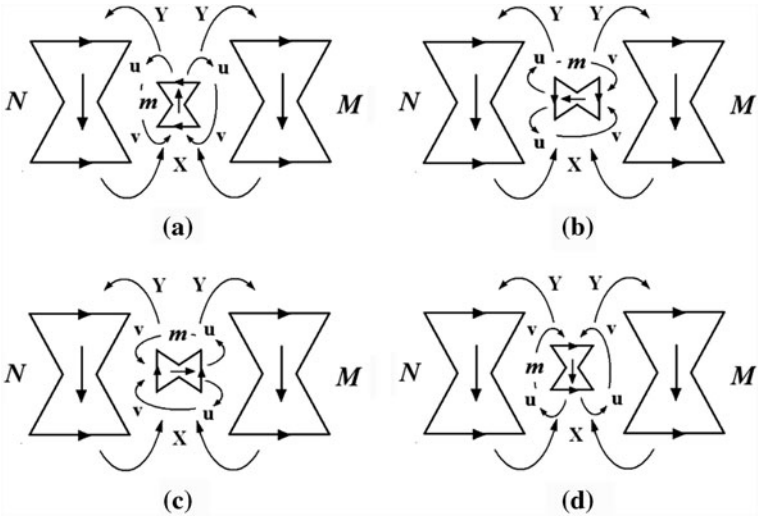

Fig. 9.4 The fate of yoyo *m* within the conflict between *N* and *M*

yoyo structure *m* will be torn apart into pieces, some of which will be absorbed by either *N* or *M*. For the situation in Fig. 9.4b, the meridian field u of *m* is pushed upward by the meridian field X of *N*, and the meridian field v of *m* is attracted downward due to the fact that the same polarities repel and opposite attract. So, yoyo *m* will spin clockwise in order to reposition itself as in that of Fig. 9.4a. If when it reaches the top of the combined meridian field of *N* and *M*, it is still in a position as shown in Fig. 9.4b, then it will be absorbed by *N*; if at that moment, it is positioned like in Fig. 9.4a, then it will be destroyed as described in the analysis of Fig. 9.4a.

For the scenario in Fig. 9.4c, once again due to the property that the like polarities repel and opposite attract, the small yoyo *m* will experience counter-clockwise spin in its general upward movement. If at the top of the combined meridian field of *N* and *M*, yoyo *m* is still in its position as in Fig. 9.4c, then it will be absorbed into *M*; if it is poisoned as in Fig. 9.4a, it then will be destroyed by the meridian fields of *N* and *M*. For the situation in Fig. 9.4d, yoyo *m* experiences an extreme instability due to its positioning of the polarities. If the field intensity of *N* and *M* working on *m* are the same, the general upward movement of *m* will be sped up. If one of meridian fields of *N* and *M* is stronger, then yoyo *m* will be lifted further upward on that side, causing *m* to spin either clockwise (if the meridian field of *N* is stronger) or counterclockwise (if the meridian field of *M* is stronger). In either case, *m* will be repositioned in one of the situation as in Fig. 9.4b or c.

This analysis provides the reason of how and when the subeddies created by the eddy fields *N* and *M* in Fig. 8.2c would be absorbed by either *N* or *M* or destroyed by the attraction forces of both *N* and *M*. For the situation shown in Fig. 8.2a, it can be depicted as in Fig. 9.5, where (b) is the side view with both *N* and

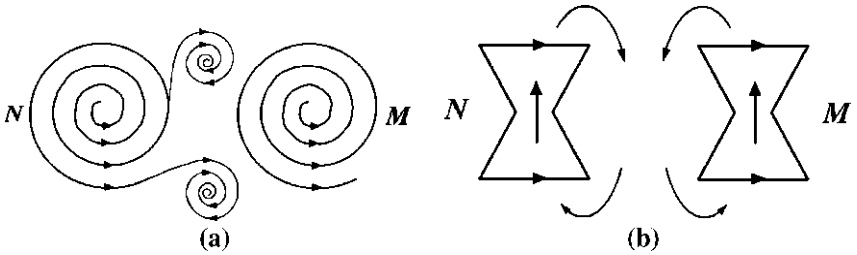

Fig. 9.5 The interaction between two harmonic divergent yoyos

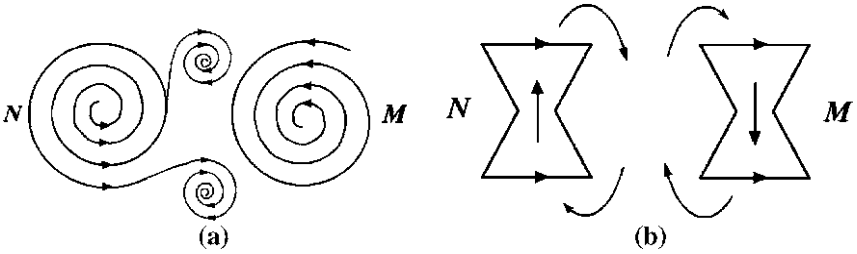

Fig. 9.6 The interaction between two not harmonic fields

M complying with the right-hand rule. This situation is similar to that analyzed above except that the upward and downward movements are switched and clockwise and counterclockwise rotations are exchanged.

For the scenario shown in Fig. 8.2b, it can be depicted as in Fig. 9.6, where the right-hand rule applies to *N* and left-hand rule to *M*.

Now, let us see how a much smaller yoyo structure *m* would survive the interaction between the two relatively greater yoyos *N* and *M* as shown in Fig. 9.6, where the small yoyo *m* is assumed to comply with the left-hand rule. Similar analysis can be carried out for the scenario of *m* that satisfies the right-hand rule. Similar to Fig. 9.4, we have the four typical scenarios in Fig. 9.7.

For the situation in Fig. 9.7a, due to the property that like polarities attract and opposite repel, the meridians Y_M and X_M of *M* attract those u_2 and v_2 of *m*, respectively; while the meridians Y_N and X_N of *N* repel those u_1 and v_1 of *m*, respectively. So, instead of moving upward or downward, small yoyo *m* will be pushed into *M* by the meridians of *N* and sucked in by the meridians of *M*. At the same time, since the meridians Y_M and X_M of *M* respectively exert attraction on m in opposite directions, in general small yoyo *m* would be torn into pieces while it is absorbed by *M*. However, if *m* is located at a point where the meridians Y_M and X_M are not the same strength, then *m* would connect with either black-hole side of *M*, if Y_M is more powerful than X_M, or the big-band side of *M*, if X_M is more powerful than Y_M. For the scenario in Fig. 9.7b, because the meridians Y_N and Y_M repel against those u_1 and v_1 of *m*, respectively, and X_N and X_M attract u_2 and v_2 at

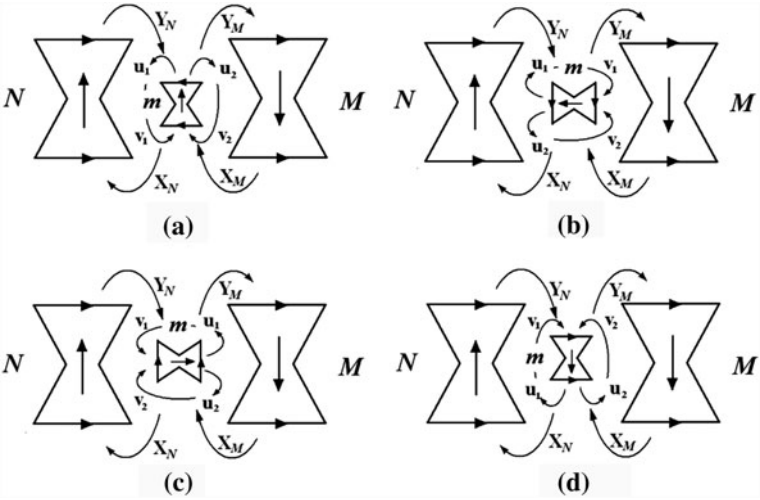

Fig. 9.7 The fate of yoyo *m* within the conflict between *N* and *M*

the same time, small yoyo *m* would experience a downward acting force and so it would move downward. However, when *m* reaches the bottom of the combined meridian fields of *N* and *M*, it might be torn apart by X_N and X_M because at this location, X_N and X_M act in opposite directions.

For the situation in Fig. 9.7c, similar to the case of Fig. 9.7b, small yoyo *m* would be acted upon by lifting forces from both Y_N and Y_M due to the fact that like polarities repel and opposite attract. However, when *m* reaches the top of the combined field of Y_N and Y_M, it might be torn apart due to the opposite directions of Y_N and Y_M. Now, for both of the cases of Figure (b) and (c) there is the possibility that if yoyo *m* is really solid, meaning that Y_N and Y_M are not strong enough to tear *m* apart, then *m* will simply find an equilibrium point in the combined field of Y_N and Y_M without joining either *N* or *M*. The situation in Fig. 9.7(d) is similar to that of Fig. 9.7a except that small yoyo *m* will be pulled over into the side of *N* instead of *M* as in the case of Fig. 9.7a, if *m* is located at a point where the strengths of Y_N and X_N are the same. Now, no matter how *m* is absorbed into *N*, from the side, on top, or on the bottom of *N*, due to opposite spinning directions, *m* will be smashed into pieces.

For the scenario in Fig. 8.2d, it can be more vividly depicted by Fig. 9.8, where (b) depicts the side view of (c), and the systemic yoyo *N* complies with the right-hand rule and *M* the left-hand rule. In Fig. 9.8b, the left-hand rule applies to the yoyo structure *M* and the right-hand rule to the structure *N*.

Similar to what we just did above, let us now analyze how a small yoyo *m* could potentially evolve within the inside the confrontation between the fields *N* and *M*. As depicted in Fig. 9.9, the small yoyo m complies with the left-hand rule. As for the situation when m complies with the right-hand rule, similar analysis can be given.

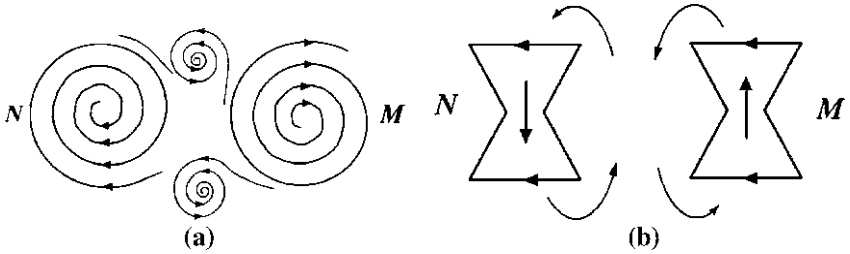

Fig. 9.8 The interaction between two not harmonic yoyo fields

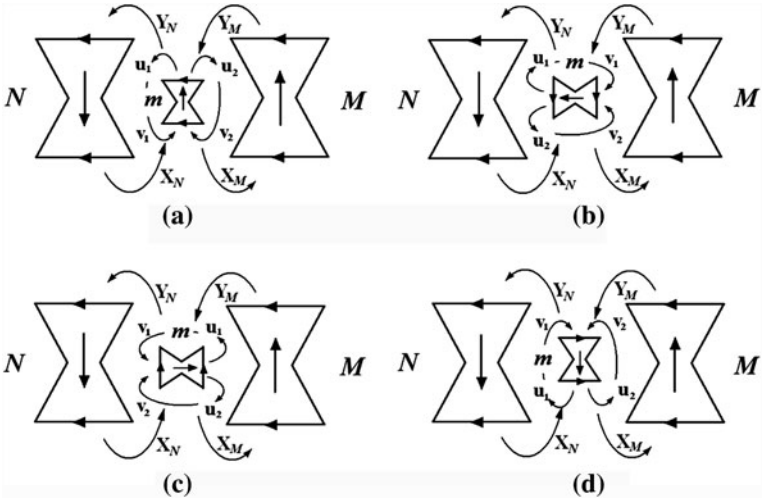

Fig. 9.9 The fate of yoyo *m* within the conflict between *N* and *M*

For the scenario in Fig. 9.9a, small yoyo *m* is attracted by the meridian fields Y_N and X_N of *N*, while repelled by Y_M and X_M of *M* due to the property that like polarities repel and opposite attract. Therefore, *m* is sucked into the field of *N*. Because the fields *N* and *m* comply with right-hand and left-hand rules, respectively, when *m* joins *N* from the top or the bottom, due to their not harmonic spin directions, the small yoyo structure *m* will be destroyed by being torn apart while it emerges into the state of motion of *N*. If *m* joins *N* from the side, which can occur if *m* is located at the point in the meridian field of *N* with equal strength in Y_N and X_N, the internal structure of *m* will have to be modified from convergence to divergence and from divergence to convergence respectively due to the alignment of opposite polarities. For the situation in Fig. 9.9b, the meridian fields Y_N and Y_M attract those of u_1 and v_1, while X_N and X_M repel u_2 and v_2, respectively; that is, small yoyo *m* experiences a lifting force so that it will move upward. Now, if the intensities of Y_N and Y_M are the same, then *m* will be torn apart with some materials of *m* going to *N* and some other materials

going to M. If the strength of Y_N is greater than that of Y_M, then the majority part of m will join N. In this case, due to the alignment of opposite spinning directions, m will be torn apart in its process of merging into the field of N. If the strength of Y_M is greater than that of Y_N, then the majority part of m will join M. In this case, because both m and M comply with the left-hand rule, small yoyo m will be accepted by M as a whole without being broken up.

For the scenario in Fig. 9.9c, due to the reason that like polarities repel and opposite attract, small yoyo m will move downward as being acted upon by the pushes of Y_N and Y_M and pulls of X_N and X_M, respectively. Now, at the bottom of the combined field of X_N and X_M, small yoyo m will experience one of the three possibilities:

(1) The strengths of the meridian fields X_N and X_M are the same but in opposite directions. In this case, the whole being of m will be destroyed so that partially it joins with N and partially it combines into M.
(2) The meridian field X_N is stronger than X_M. In this case, small yoyo m will be absorbed into N. Now, due to opposite spinning directions, when it is merged into N, m will be destroyed; and
(3) The meridian field X_M is stronger than X_N. In this case, small yoyo m will smoothly combine with M due to the existing harmonic spinning directions.

For the situation in Fig. 9.9d, small yoyo m will be pushed by the meridian fields Y_N and X_N and pulled by Y_M and X_M into M. Now, there are also three different ways for m to join with M:

(1) If m is located at the point in the meridian field of M where the strengths of Y_M and X_M are the same, then m will be smashed into M from the side. In this case, the internal structure of m will have to be destroyed in order to fit the new environment within the inside of M.
(2) If at where m is located Y_M is stronger than X_M, then m will connect with M on the top of M as a whole spinning field; and
(3) If at where m is located X_M is stronger than Y_M, then m will connect with M on the bottom of M as a whole spinning field.

For the systemic yoyo model analysis of how small yoyos are bullied or destroyed by larger fields, as depicted graphically in Figs. 9.4, 9.7, and 9.9. Case Study 9.3 in Sect. 9.4 below provides a historical account by looking at Henry J. Kaiser's attempt of entering the automobile industry and how he failed under the field pressure of the existing automakers.

For now, let us return to our discussion on how potentially economic yoyos could interact with each other. As long as the flow of demands is unstable (see the analysis in Chap. 8), all the relevant economic yoyos will continue to fight for their very

(1) Existence,
(2) Survival, and then
(3) Possible expansion, which in turn is for the purpose of survival.

When the picture of interaction between various demand forces begin to crystallize, that is, when the acting and reacting forces start to stabilize, the intensive struggles for market shares between the relevant economic yoyos will decline to a minimal level and the entire economic sector begins to stabilize. This description is based on studies of fluid motions (OuYang 1994) without using any of the terminology.

Now, if each economic yoyo, representing an individual company, in the previous imagined picture is replaced by such a bigger economic yoyo that represents an economic sector or industry, then a similar evolution of struggles for market share or the available resources and profit opportunities between industries or economic sectors would exist. This evolution of struggle would be dynamic if we place it in the flow of time. In particular, some yoyos, representing economic sectors or industries, will have the tendency to combine into greater yoyos and others may break apart into smaller yoyos or simply disappear. (For the in-depth discussion about when a yoyo structure might be taken or simply disappear, see the previous discussion in this section. And a historical account about how greater and mightier economic yoyos could potentially be formed by absorbing relevant business entities, see refer to Case Study 9.4 in Sect. 9.4 below). This process of evolution is similar to that of a current of fluid rushing down a high land. If the boundary conditions are complicated, the state of the current flow pattern will be difficult to model by using the traditional calculus-based mathematics. It is because the overall state of motion is moving downward mixed with local variations, such as jet streams, and whirlpools of different sizes, strengths, and directions. So, if we take a snap shot for the evolution of economic power struggle between the economic yoyos of various industries, in the still momentary picture, we can expect to see spinning yoyos of different sizes, meaning some industries (yoyos) suck in more profits and human resources than others. It is reasonable to expect that industries, whose yoyo structures suck in more profits and other available resources, behave differently than other industries. For how large industries might behave differently from small ones, please refer back to the systemic yoyo structure analysis along with Figs. 9.2 and 9.9. In the analysis of these figures, it is pointed out that when the small yoyo is absorbed into one of the two giant fields, if the receiving field and the small yoyo do not spin in the same direction, then the small yoyo will be torn apart into pieces. Case Study 9.5 in Sect. 9.4 shows what could happen if these two fields were of roughly the same intensity. That is, both of the fields would ease to exist.

The qualitative and figurative analyses of economic yoyos as above can be continued along a line parallel to the evolution process of a fluid motion and a corresponding mathematical analysis can be introduced to support such a qualitative analysis as is done in the study of fluid mechanics. In the following, we will establish a simple analytic model based on the premise of the yoyo model to see the analysis above actually works out mathematically. In particular, it will be shown along with other results that financially resourceful companies in general have more opportunities to make profits than those that are not financially sound. So, this conclusion verifies the theoretical result that financially resourceful

companies are in such advantageous situations that they could easily bully others as discussed above using systemic yoyo model, here each financially resourceful company is abstractly modeled as a giant yoyo structure, while any financially constrained firm a tiny spin field.

9.2 An Analytic Model for Comparing Profit Potentials Under Different Capital Conditions

This model consists of two versions. One is constructed for the case where the capital market is perfect, in which business people can borrow any amounts of money as needed for their ventures. The other version is established for the situation where the capital market is not perfect. By altering the meanings of the key terms and concepts involved, this model together with other models will be employed to investigate the dynamics of small and large projects in Chap. 10 later. In terms of the systemic yoyo model, the first scenario is equivalent to the situation that a yoyo structure exists in isolation without any interaction with other yoyo fields. So, the second scenario is more realistic. On the other hand, case studies in Chap. 10 will show that the ideal scenario of the first version of the model does appear in the physical world.

9.2.1 A Retail Company with Abundant Financial Resources

Assume that a retailer sells a specific product for $\$p_s$ each unit. (The analysis is done in terms of this fictitious retailer. However, the relevant conclusions also hold true for other kinds of the general commercial firm, be they manufacturers, transportations, and others.) The total cost for the entire process of acquiring the product, shipping and handling, insurance, storage, salesmen's salary, etc., is $\$p_p$ each unit. Let $n = n(p_s)$ be the total number of units sold at the price $\$p_s$ per unit. Then, for this particular retailer, his profit from this single line of product is given by

$$P = \text{ profit } = n(p_s)\big(p_s - p_p\big). \tag{9.1}$$

If the retailer can borrow as much funds to purchase or produce as many units of the product as he needs to at any desirable time, then he would determine such a selling price $\$p_s$ so that his profit P in Eq. 9.1 will be maximized. The first order condition for this maximization problem is given below:

$$\frac{\partial P}{\partial p_s} = n'(p_s)\big(p_s - p_p\big) + n(p_s) = 0. \tag{9.2}$$

For each fixed p_s- and p_p- values, we have

$$n'(p_s) = -\frac{n(p_s)}{p_s - p_p}. \tag{9.2a}$$

Writing this equation with the variables $n(p_s)$ and p_s separated as follows:

$$\frac{n'(p_s)}{n(p_s)} = -\frac{1}{p_s - p_p}$$

. Integrating both sides of this equation leads to

$$\ln|n(p_s)| = \ln|p_s - p_p| + C.$$

where C is the integration constant. Simplifying this equation provides the solution of Eq. 9.2a as follows:

$$n(p_s) = \frac{C}{p_s - p_p}, \tag{9.3}$$

If at the price level p_{s0} the initial market demand for the product is $n(p_{s0})$ units, then Eq. 9.3 implies that $C = n(p_{s0})(p_{s0} - p_p)$. Substituting this C-value and Eq. 9.3 into Eq. 9.1 leads to

$$P = \text{ profit } = n(p_{s0})(p_{s0} - p_p). \tag{9.4}$$

Eq. 9.3 implies that when the constant C is positive, the retailer has a chance to make a profit on each unit of his product, meaning $p_s > p_p$. In this case, $n(p_s)$ increases indefinitely as the selling price $p_s \to (p_p)^+$. On the other hand, when the constant C is less than 0, the retailer could choose to get rid of his product by selling it at a price p_s below the cost p_p, if he likes to clear out his specific line of product. Additionally, Eq. 9.3 also implies that to improve his market share, the retailer has to keep the unit price p_s as close to the cost basis p_p as much as possible in order to maximize the marker demand $n(p_s)$.

From Eq. 9.4, it follows that to optimize his profit P, if the retailer can keep the difference $(p_{s0} - p_p)$ constant, then the lower the p_{s0}-value the greater the demand $n(p_{s0})$ and the greater his total profit P. In this case, he will need to keep his per-unit cost p_p low. To achieve this, the only efficient strategy for the retailer to take is to locate a manufacturer who can massively produce the needed product at a price below all other competitors. This understanding explains naturally why manufacturers have been relocating themselves in different geographic locations with as ideal labor bases as possible. In terms of the systemic yoyo model, it means that the sea of economic yoyos (the manufacturers) starts to flow, caused by the uneven force of competition. This end explains why the current trend of moving manufacturing operations from industrialized nations to the third world countries does not seem reversible in the foreseeable future as long as the international transportation costs stay low and the global economic system stays open and competitive. As a matter of fact, this end is simulated well by the fluid patterns found in the dishpan experiment, where the Hide's dishpan experiment has been described in Chap. 4. However, for our purpose here, let us look at Fultz's version of dishpan experiment.

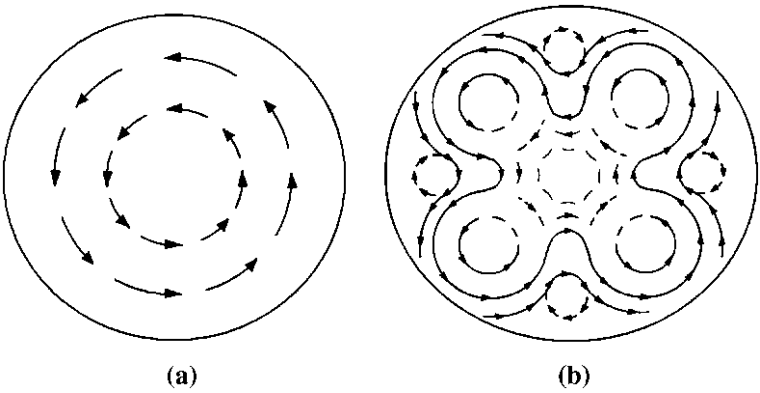

Fig. 9.10 Patterns observed in Fultz's dishpan experiment

In the late 1950s, Dave Fultz (Fultz et al. 1959), partially filled a cylindrical vessel with water, placed it on a rotating turntable, and subjected it to heating near the periphery and cooling near the center. The bottom of the container is intended to simulate one hemisphere of the Earth's surface; the water, the air above this hemisphere; the rotation of the turntable, the Earth's rotation; and the heating and cooling, the excess external heating of the atmosphere in low latitudes and excess cooling in high latitudes. To observe the pattern of flow at the upper surface of the water, which was intended to simulate atmospheric motion at high elevations, Fultz sprinkled some aluminum powder. A special camera that effectively rotated with the turntable took time exposures so that a moving aluminum particle would appear as a streak, and sometimes each exposure ended with a flash, which could add an arrowhead to the forward and end of each streak. The turntable generally rotated counterclockwise, as does the Earth when viewed from above the North Pole.

Although everything in the experiment was arranged with perfect symmetry about the axis of rotation, such as no impurities added in the water, and the bottom of the container was flat, Fultz and his colleagues observed more than they bargained for. First, both expected flow patterns, as shown in Fig. 9.10, appeared and the choice depended on the speed of the turntable's rotation and the intensity of the heating. Briefly, with fixed heating, a transition from circular symmetry (Fig. 9.10a) would take place as the rotation increased past a critical value. With the sufficiently rapid but fixed rate of rotation, a similar transition would occur when the heating reached a critical strength, while another transition back to symmetry would occur when the heating reached a still higher critical strength.

Now, to fit the intensified competition between manufacturers as just discussed, let us fathom this Fultz's dishpan experiment as follows: the periphery is made up of slower moving or static fluid. As the struggle between the economic forces within the inside of the "dish" of rotating fluid reaches a high level, a similar transition from the perfect symmetry (Fig. 9.10a) would occur. However, in this case, the abstract dish does not have a solid periphery to hold all the intensified struggles within the inside

dish. So, a great deal of the imbalanced forces within the abstract dish would break out of the internal structure of the rotating fluid; and at the same time, some of the materials and forces from the external environment will be brought into the dish. These two processes of movement of energy and materials are shown vividly in Fig. 9.10b at the locations on either sides of the complete circular movements along the periphery.

Now, by analyzing the previous model, we have the following:

Proposition 9.1 *Assume that the capital markets are perfect. If at a unit-selling price* $p_s = p_{s0}$ *and at a unit cost basis* $p_p = p_{p0}$*, the total profit* $P(p_s, p_p)$ *from selling the product satisfies*

1. $\left.\dfrac{\partial P}{\partial p_s}\right|_{p_s=p_{s0}} < -n(p_{s0})$, *then the retailer can reduce his unit-selling price* p_{s0} *to increase his total profit; or*
2. $\left.\dfrac{\partial P}{\partial p_p}\right|_{p_p=p_{p0}} > n(p_{p0})$, *then the retailer can increase his unit-cost basis* p_{p0} *to reap in additional profits; or*
3. $\left.\dfrac{\partial P}{\partial p_s}\right|_{p_s=p_{s0}} < -n(p_{s0})$ and $\left.\dfrac{\partial P}{\partial p_p}\right|_{p_p=p_{p0}} > n(p_{p0})$, *then the retailer can both reduce his unit-selling price* p_{s0} *and increase his unit-cost basis* p_{p0} *to boast his total profit from his specific line of product.*

Proof Let in Eq. 9.1 the selling price p_s drop as much as $\Delta p_s > 0$ per unit. If the retailer does not pick up any additional market demand for his product at the reduced price $(p_s - \Delta p_s)$, then he would have a loss in the amount of $n(p_s)\Delta p_s$. So, if at the lower unit price level, the retailer expands the market demand $n(p_s)$ to that of $n(p_s - \Delta p_s)$ and if the profit increment $P(p_s - \Delta p_s) - P(p_s)$ is greater than the theoretical loss $n(p_s)\Delta p_s$, that is,

$$n(p_s - \Delta p_s)(p_s - \Delta p_s - p_p) - n(p_s)(p_s - p_p) > n(p_s)\Delta p_s, \tag{9.5}$$

then the retailer would rather reduce his unit-selling price p_s to maximize his profit. Now, Eq. 9.5 is equivalent to the following:

$$\frac{dP(p_s)}{dp_s} = \lim_{\Delta p_s \to 0^+} \frac{P(p_s - \Delta p_s) - P(p_s)}{-\Delta p_s} < -n(p_s). \tag{9.6}$$

To this end, if instead of reducing the per-unit-selling price p_s by an increment $\Delta p_s > 0$, the unit-cost basis p_p is increased by an increment $\Delta p_p > 0$. If the retailer does not pick up any additional demand for his product with his increased cost basis, then he would experience a loss in the amount of $n(p_p)\Delta p_p$. However, if such an increase in his cost basis produces a new market demand $n(p_p + \Delta p_p)$ and the change in profit P satisfies

$$P(p_p + \Delta p_p) - P(p_p) > n(p_p)\Delta p_p, \tag{9.7}$$

then the retailer would rather increase his unit-cost basis by as much as necessary in order to maximize his profit. Now, Eq. 9.7 is equivalent to the following

$$\frac{dP(p_p)}{dp_p} = \lim_{\Delta p_p \to 0^+} \frac{P(p_p + \Delta p_p) - P(p_p)}{\Delta p_p} > n(p_p). \tag{9.8}$$

Combining Eqs. 9.6 and 9.8 provides the desired conclusions. □

The previous analysis also implies that if by reducing his unit profit $(p_s - p_p)$ the retailer can greatly increase his total profit by gaining additional market demand, he will do whatever necessary to accomplish that goal. More specifically, among other possibilities, he might

(1) Launch an aggressive commercial campaign where p_p is increased in order to expand the market demand; for supporting evidence, please consult with Case Study 8.1, where each of the personal computer manufacturers spent huge amounts of capital on commercial promotions and campaigns. Also, as shown in Case Study 8.2, Gussie Busch, CEO of Anheuser-Busch, went as far as purchasing the St. Louis Cardinals in order to capture the market of a vast region for his product, Budweiser and its sister brands. The reason why such activities would work is because from the First Law on State of Motion (Sect. 4.3), it follows that when one wants the behaviors of the surrounding yoyo fields to change, he has to exert additional forces on the environment.
(2) Acquire larger number of units of the product at a much lower price where p_p is decreased so that p_s can be accordingly lowered to attract more customers. This tactic was well employed by discount retailers, for more details, see Case Study 8.4. Similarly, Henry Ford also utilized this approach to reach the American public of ordinary men and women, as shown in Case Study 8.3, where in 1929, Packard's profits came to $25 million, or $577 per car, while Ford produced 1,507,132 cars with a profit of less than $50 per car. Our analysis clearly explains why Packard is no longer around, while Ford is still going strong. In particular, the yoyo structure of Packard interacted only with a special pool of economic fields, while the field structure of Ford was intertwined with all existing fields in its environment. So, when Packard's special pool dwindled during and after the Great Depression, Ford was not affected.
(3) Lower per-unit shipping and handling costs with increased volume of business. To this end, see Case Study 8.4 for how E. J. Korvette practically eliminated all its shipping and handling costs in its discount operations.
(4) Increase the salesmen's wages. With such a potential of drastically increasing take-home pays, the salesmen would work harder and smarter so that the market demand is consequently pushed to new extremes. This strategy was well employed by Schiltz in its management of different brands of beers (Case Study 8.2), where each brand had its own manager who was responsible for all aspects of the production, marketing, and selling. And, this analysis is also evidenced by how Packard arranged its showrooms in order to acquire the attention and business of the America's wealthiest and most famous in Case Study 8.3.

9.2.2 A Retail Company with Limited Financial Resources

In this subsection, we add one constraint to the previous model to reflect the realistic scenario that for many business entities the capital market is far from being perfect. That is, business activities of the fictitious retailer in our analysis now are greatly limited by his inability to borrow money and to attract investment funds. In symbols, the profit P in Eq. 9.1 is subject to the following constraint:

$$n(p_s)p_p = I, \tag{9.9}$$

where I stands for the total available funds for the retailer to invest in his line of product and $n(p_s)$ is now seen as the size of his inventory. The first order conditions for maximizing the profit P subject to the constraint in Eq. 9.9 are given by

$$\frac{\partial P}{\partial p_s} = n'(p_s)(p_s - p_p) + n(p_s) = \lambda n'(p_s)p_p \tag{9.10}$$

and

$$\frac{\partial P}{\partial p_p} = n'(p_s)\frac{dp_s}{dp_p}(p_s - p_p) + n(p_s)\left(\frac{dp_s}{dp_p} - 1\right) = \lambda\left[n'(p_s)\frac{dp_s}{dp_p}p_p + n(p_s)\right], \tag{9.11}$$

where λ is the Lagrange multiplier. Substituting Eq. 9.10 into Eq. 9.11 leads to

$$(1 + \lambda)n(p_s) = 0.$$

Eq. 9.9 implies that $n(p_s) \neq 0$, which means $\lambda = -1$. So, Eq. 9.10 becomes

$$n'(p_s)p_s = -n(p_s).$$

Solving this equation for $n(p_s)$ gives us

$$n(p_s) = \frac{n(p_{s0})p_{s0}}{p_s}, \tag{9.12}$$

where $n(p_{s0})$ is the initial market demand when the product is sold for $\$p_{s0}$ per unit. So, the retailer's profit P is given by

$$P = \text{ profit } = \frac{n(p_{s0})p_{s0}}{p_s}(p_s - p_p) \tag{9.13a}$$

$$= n(p_{s0})p_{s0}\left(1 - \frac{p_p}{p_s}\right). \tag{9.13b}$$

Eq. 9.12 indicates that to expand the market demand, the retailer has to decrease his unit-selling price. Because the retailer has a limited financial resources to invest in his product, he is unable to compete with any retailer who has unlimited resources. Similar to the situation of a financially powerful retailer,

this small retailer can also increase his profit by reducing his selling price p_s, if he can keep the unit profit ($p_s - p_p$) constant. However, unlike the powerful retailer in the previous analysis, our current retailer has a cap, $n(p_{s0})p_{s0}$ (Eq. 9.13b), which stands for how much he can expand his potential of total profit. This comparison tells us the following two facts:

(1) When financial resources are limited, any venture will have a glass ceiling for its maximum level of profits. This conclusion is strongly supported by the operations of Montgomery Ward under the leadership of Sewell Avery in Case Study 8.5, where due to his incorrect prediction about the post WW II economy, although Montgomery Ward did relatively well during the postwar economic boom, its overall performance was limited by an invisible glass ceiling. That led to the eventual failure of the once mighty business entity in American retail industry. Intuitively, when the materials coming into a spinning yoyo are limited, the size of the yoyo field (that stands for the existence of the glass ceiling) has to be constrained, no matter how large the yoyo itself wants to grow.
(2) Because of their limited resources, small retailers or poorly funded ventures do not have many opportunities to locate extremely low-priced manufacturers or any kind of volume-related discount. One reason is that they do not have the ability to place large orders and two because they do not have the financial strength to create their own low-priced manufacturing operations to strengthen their ability to compete. Once again, this scenario is evidenced by the manufacturing operations of Montgomery Ward under the leadership of Sewell Avery during the post WWII era when all the relevant units of production were starved with cash and adequate investment.

By comparing Eqs. 9.13a and 9.13b to conclusions (1)–(4) in Sect. 9.2.1, we can see the following facts:

(1) While financially powerful companies are promoting their product to expand their market share and appearance, such as the case with Anheuser-Busch in Case Study 8.2, where the company was heavily involved in sports and entertainment, companies with limited financial abilities cannot afford to devote much of their scarce resources to do so, such as the case with the cash-starving Montgomery Ward under its CEO Sewell Avery in Case Study 8.5 and the case with E. J. korvette, a pioneer in discount retailing, at its early stages of development of Case Study 8.4. One of the many reasons is that companies with limited financial resources do not have much money to promote themselves. Another key reason is that, as Eq. 9.13b indicates, excessive amount of spending will definitely keep their unit-selling price p_s high. To increase their profit potential, these companies have to control their spending so that their profit can be maximized by lowering their unit-selling price p_s.
(2) While financially powerful companies are placing large orders at much reduced wholesale prices, companies with limited resources just do not have such opportunities available to them. Similarly, other volume-related savings are not available to ventures with limited resources. This end is well illustrated

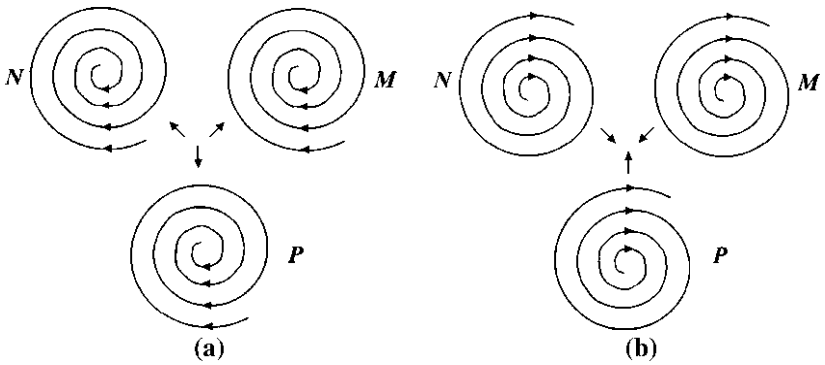

Fig. 9.11 The existence of a trinary star system

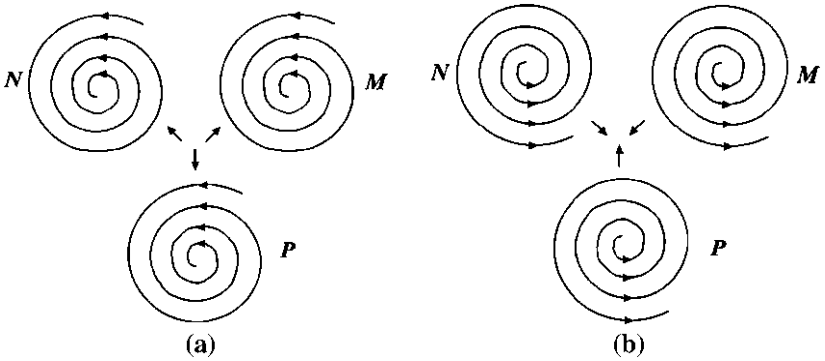

Fig. 9.12 The existence of an opposite spinning tri-nary star system

in Case Study 8.4 when in 1931, Congress passed and President Roosevelt signed the Robinson-Patman Act to protect small businesses from unfair competition created by quantity purchases of large retailers. However, history still clearly shown that in general companies with the ability to make quantity purchases do better than those mom-and-pop operations.

In this following section, we will make use of the model established here to support the evidence that in the ocean of economic eddies, some whirlpools would have the ability to acquire more strength than others. It is because based on the analysis of the existence of a binary-star system, Figs. 9.2 and 9.3, all harmonically spinning convergent yoyo structures would form a super large *n*-nary system, where *n* stands for an arbitrary natural number. In particular, when three harmonically spinning fields, as shown in Fig. 9.11, exist side-by-side, the convergent sides attract each other, while the divergent sides repel against each other, so that a cohesive, gigantic overall spinning field is formed. At the same time, yoyo structures as shown in Fig. 9.12 will form another gigantic overall spinning field,

which rotates in the opposite direction as that in Fig. 9.11. These two individually cohesive fields, spinning in opposite directions, will not combine. Instead, they will fight against and complement each other. That is they co-exist along with each other, forming the so-called duality of eddy motions.

9.3 Wage Differentials: A Sure Sign of Varied Strengths of Economic Yoyos

For years, an interesting interindustrial wage pattern has caught the attention of numerous scholars from around the world. What has been observed is that the wages of people working for some industries are higher than those working in other industries. The most inexplicable is that in a higher paying industry, all occupations, from the key personnel to those who provide supporting services, such as janitors, are paid at higher rates than their counterparts in other industries. To fathom this economic phenomenon, in the past half a century various theories have been developed so that the interindustrial wage differentials can be in at least partially explained. Here are some of the known theories and their weaknesses:

(1) Unpleasant and unsafe working environment. That is why certain industries have to pay higher market wages to attract workers.
(2) Higher wages are used to acquire employees with better measurable and immeasurable labor quality (Murphy and Topal 1987). However, as shown by (Thaler 1989), the uniformity of wage differentials across occupations works against both theory (1) and this explanation. By identifying "the unobserved abilities" as intelligence, in particular, as IQ test scores, Blackburn and Neumark (1988) find that there is a negative relationship between an industry's wage and the average IQ scores of its employees.
(3) As anything in life, difference in compensation naturally exists between industries (Rosen 1986). But, this explanation still cannot explain why such compensation differences exist from one industry to another.
(4) It has been shown that employees' effort $e(w)$ is an increasing function of his wage rate w (Shapiro and Stiglitz 1984; Stiglitz 1976; Weiss 1980).
(5) Higher paying firms tend to monitor their workers' performance and fire those who are caught shirking. All models established on this and theory (4) indicate that high wage industries are those with high monitoring costs or those bearing high costs of employee shirking. However, when comparing this result against what are really seen in the business world, it can be seen that this conclusion is not entirely correct.
(6) Better wages are utilized to reduce the rate of employees' quits so that savings can be realized from hiring and training workers (Hamermesh 1993; Salop 1979; Stiglitz 1974).
(7) If possible, firms like to make their employees feel they are paid fairly (Akerlof and Yellen 1990; Solow 1979; Kahneman, Knetsh and Thaler 1986;

Yellen 1984). Evidently, theories of (6) and (7) do not provide a convincing explanation for the interindustry wage patterns.

(8) When firms have the ability to pay higher wages, they do so generally. However, intuition tells us that this explanation does not make sense, because each dollar wage increase means a dollar dividend less for the stockholders. This end is against the nature of the investing public.

(9) The appearance of high wages is a consequence of labor union density, etc. To this end, analysis below shows that labor unions are attracted to high wage industries instead of the other way around.

In the following, we will establish a systemic yoyo model explanation and an analytic reasoning for the phenomenon of interindustrial wage differentials. First, let us use the yoyo methodology to intuitively understand why such a pattern in the flow of money exists. From Figs. 9.4, 9.7, and 9.9, it can be seen that in the confrontations between spin yoyo fields, tiny fields are bullied around by other larger rotational fields existing in the environment; and each tiny field is either destroyed or absorbed by giant yoyo structures. This fact intuitively explains why materials residing in tiny yoyos in general do not possess as much strength or intensity as those from a giant yoyo structure. As shown in Fig. 9.1, income is surely a sign of strength and intensity for each of the tiny fields and their employees.

As for developing an analytic explanation, let us utilize the model of the previous section to explain the interindustry wage differentials clearly. Assume that a company produces and sells a line of special product. Then, the company has two sources of income: (1) producing and selling the product, and (2) hiring each worker because each worker generates additional profits for the company after having covered all the relevant costs of the workers. Symbolically, from each unit of the product produced and sold, the company makes as much profit as $p_s^p - p_p^p$, where p_s^p is the per-unit-selling price and p_p^p the unit-cost. And for each worker it hires, the company generates as much profit as $p_s^W - p_p^W$, where p_s^W is the average revenue a worker is expected to make and p_p^W the average cost associated with keeping a worker employed. Corresponding to the cases analyzed in Sect. 9.2, let us consider two separate scenarios.

9.3.1 The Company is Financially Resourceful

In this case, Eqs. 9.3 and 9.4 imply that the market demand for the company's product is

$$n_p\left(p_s^p\right) = n_p\left(p_{s0}^p\right)\frac{p_{s0}^p - p_p^p}{p_s^p - p_p^p}(\text{units}) \tag{9.14}$$

and the total profit from selling its product is

$$P^p = \text{ profit of its product } = n_p\left(p_{s0}^p\right)\left(p_{s0}^p - p_p^p\right), \tag{9.15}$$

where $n_p\left(p_{s0}^p\right)$ is the initial market demand for the product selling at $\$p_{s0}^p$ per unit. Equation 9.14 implies that when $p_s^p \to \left(p_p^p\right)^+$, the demand will approach infinity. Equation 9.15 indicates that if the unit profit $\left(p_{s0}^p - p_p^p\right)$ stays constant, the lower the p_{s0}^p-value the greater the demand $n_p\left(p_{s0}^p\right)$ and the greater the total profit P^p.

Similarly, the company's staffing need is given by

$$n_W\left(p_s^W\right) = n_W\left(p_{s0}^W\right)\frac{p_{s0}^W - p_p^W}{p_s^W - p_p^W}(\text{persons}) \tag{9.16}$$

and the total profit from hiring $n_W\left(p_s^W\right)$ employees is given by

$$P^W = \text{ profit of personnel } = n_W\left(p_{s0}^W\right)\left(p_{s0}^W - p_p^W\right), \tag{9.17}$$

where $n_W\left(p_{s0}^W\right)$ stands for the company's initial need for additional personnel, hired at the initial expected revenue $\$p_{s0}^W$ per worker.

For the staffing need, Eq. 9.16 implies that the higher the initial p_{s0}^W–value the more workers the company would need to hire initially. Then, the smaller the difference $\left(p_s^W - p_p^W\right)$ is and the smaller p_p^W is controlled to be, the greater number $n_W\left(p_s^W\right)$ of workers will be needed. When Eqs. 9.16 and 9.17 are combined, it can be seen that if the difference $\left(p_{s0}^W - p_p^W\right)$ stays fixed, the closer $p_s^W \to \left(p_p^W\right)^+$, the greater the $n_W\left(p_s^W\right)$-value and the greater the total profit P^W. Now, $p_s^W \to \left(p_p^W\right)^+$ means that when the p_s^W-value is relatively stable, p_p^W should be increased as much as possible. That is, workers' wages can go up so that the total per-employee cost can approach the expected per-employee revenue p_s^W as much as possible.

When the p_p^W-value is increasing, the per-unit product cost p_p^p will also increase accordingly. But, Eqs. 9.14 and 9.15 indicate that as long as the difference $\left(p_{s0}^p - p_p^p\right)$ does not decrease and $\left(p_s^p - p_p^p\right)$ drops, the total profit from the line of product will continue to go higher. That is, our analysis leads to the following result.

Proposition 9.2 *If a business venture is well funded, assume all other aspects of the operation stay the same, then*

(1) *The market demand for the product increases as the unit-selling price drops close to the unit-cost basis, while the total profit increases drastically;*
(2) *The company taking on the venture will hire additional employees at higher than competitive wage rates with the total profit soaring.*

Corresponding to Proposition 9.1 in terms of hiring employees, we have the following:

Proposition 9.3 *Assume that the company has all necessary funds for its operation. If at the expected revenue level* $p_s^p = p_{s0}^p$ *a new hire would generate for the company and at a total cost* $p_p^W = p_{s0}^W$, *the total profit* $P^W\left(p_s^W, p_p^W\right)$ *all employees together are expected to generate satisfies*

i. $\left.\frac{\partial P^W}{\partial p_s^W}\right|_{p_{s0}^W} < -n_W\left(p_{s0}^W\right)$, *then the company can reduce its expected per-employee revenue* p_{s0}^p *to increase its total profit; or*

ii. $\left.\frac{\partial P^W}{\partial p_p^W}\right|_{p_{p0}^W} > n_W\left(p_{p0}^W\right)$, *then the company can raise its expected per-employee cost basis* p_{p0}^p *to reap in additional profit; or*

iii. $\left.\frac{\partial P^W}{\partial p_s^W}\right|_{p_{s0}^W} < -n_W\left(p_{s0}^W\right)$ *and* $\left.\frac{\partial P^W}{\partial p_p^W}\right|_{p_{p0}^W} > n_W\left(p_{p0}^W\right)$, *then the company can both reduce its expected per-employee revenue* p_{s0}^p *and raise its per-employee cost basis* p_{p0}^p *to maximize its overall profit.*

9.3.2 The Company Has Limited Financial Resources

When the company has limited resources, the model in Sect. 9.2.2 applies. The total profit is given by

$$P_{\text{total}} = P^p + P^W = n_p\left(p_s^p\right)\left(p_s^p - p_p^p\right) + n_W\left(p_s^W\right)\left(p_s^W - p_p^W\right), \tag{9.18}$$

subject to the budget constraint:

$$n_p\left(p_s^p\right)p_p^p + n_W\left(p_s^W\right)p_p^W = I, \tag{9.19}$$

where I is the total available funds of the company. By solving the maximization problem of Eq. 9.18 subject to Eq. 9.19, we establish the following results:

$$n_p\left(p_s^p\right) = \frac{n_p\left(p_{s0}^p\right)p_{s0}^p}{p_s^p} \tag{9.20}$$

$$n_W\left(p_s^W\right) = \frac{n_W\left(p_{s0}^W\right)p_{s0}^W}{p_s^W}, \tag{9.21}$$

and

$$P_{\text{total}} = P^p + P^W = \frac{n_p\left(p_{s0}^p\right)p_{s0}^p}{p_s^p}\left(p_s^p - p_p^p\right) + \frac{n_W\left(p_{s0}^W\right)p_{s0}^W}{p_s^W}\left(p_s^W - p_p^W\right) \tag{9.22}$$

$$= n_p\left(p_{s0}^p\right)p_{s0}^p\left(1-\frac{p_p^p}{p_s^p}\right)+n_W\left(p_{s0}^W\right)p_{s0}^W\left(1-\frac{p_p^W}{p_s^W}\right), \tag{9.23}$$

where $p_{s0}^p\, n_p\left(p_{s0}^p\right)$ and $p_{s0}^W\, n_W\left(p_{s0}^W\right)$ are defined the same as in Sect. 9.3.1.

Additional to what are concluded in Sect. 9.2.2, Eq. 9.21 also indicates that to hire more employees the company has to lower the average expected per-worker revenue. Because the capital markets are not perfect to the company, this end implies that the company has to limit how many workers it could afford to hire. To maximize its profit from human resources, Eq. 9.23 implies that $p_s^W \gg p_p^W$. So, in such a company with limited resources, it can either hire a relatively large number of employees at low wage rates or hire a relatively small number of high quality workers at a relatively higher wage rates. For the latter case to occur, the workers' productivity must be very high, which in general means that the company needs to invest a great deal in technology. And, this end might not be possible. Together with the company's weak financial standing, high quality worker option may never be practically possible for the company to take.

When Eq. 9.23 is compared to Eq. 9.17, the following can be seen:

(1) Financially resourceful companies can spend extra money on workers' retraining programs to lower the average per-worker cost basis p_p^W, while firms with limited resources cannot. It is because in the latter case, extra spending would increase both p_s^W- and p_p^W-values. So, the ratio p_p^W/p_s^W may not change in the favorable direction to the firms.
(2) Similar reasoning indicates that financially resourceful companies can afford to invest in programs to make their workers feel good and to raise their morale, while firms with limited resources just cannot afford such luxuries. Consequently, workers in financially strong firms produce more and are less likely to quit when compared to those hired by financially strained companies.
(3) While financially resourceful companies hire large numbers of workers so that these companies can easily reduce their per-employee benefit costs, companies with few workers have to pay the inflated market prices for the same benefit packages. That is, volume savings are not available to firms with limited resources.

This analysis together with the yoyo model investigation, as shown above, in fact provides a plausible economic explanation for

(1) Why high wage industries tend to have low quit rates (Katz and Summers 1989; Akerlof et al. 1988). It is because of a sense of job security, created on the basis of the financial strength of the firms, being treated with respect, since each of the employee is correctly seen as a source of income for the company, and the feeling of being paid in excess of their opportunity costs. In terms of the yoyo model, high wage industries (or companies) are those yoyos that spin powerfully so that fewer objects could escape their spin fields.

(2) Why firm sizes are an indicator of the levels of compensation (Brown and Medoff 1989; Groshen 1988). It is because large firm sizes reflect the market share the firms occupy and how much they make from the head count of their workers. In terms of the yoyo model, the large size of an industry or firm shows its volume of materials, including profits, being sucked in from the black-hole side and given off from the big-bang side.
(3) Why accounting profits and market power are reliable predictors of industry wages (Thaler 1989) because they indicate how fast the products and workers are generating revenues for their firms. From the angle of spinning yoyos, they are indicators of the speed of materials being sucked into and being given off the yoyo structure of the industry or firm.
(4) Why the association between wages and labor's share of costs in an industry is negative (Slichter 1950). It is because in Eq. 9.16, to reduce the value of the difference $(p_s^W - p_p^W)$, the firm may well spend a good amount of money to improve productivity by modernizing its technology, while raising its workers' wages disproportionably slowly. In the economic yoyo of an industry, the overall spinning strength has to be distributed among all aspects of the big-bang side. And workers' wages are only one aspect of the many.
(5) Why industries with high capital labor ratios tend to pay higher wages (Lawrence and Lawrence 1985; Dickens and Katz 1987). The previous analysis indicates that if a firm requires a high level of capital investment for its operation, the unit product cost of the firm must be high compared to that of firms operating on relatively much lower budgets. Eq. 9.15 implies that for such a capital intensive firm, the initial unit profit $(p_{s0}^p - p_p^p)$ must be high enough for investors to put up the necessary venture capital. After achieving the initial business success, continued capital investment at high levels will be needed in order to reduce the unit-cost basis p_p^p by heavily investing in advanced and innovative technology in order to increase the per-worker productivity. Also, for a long period of time, the delicate technology may require large amounts of capital to maintain.
(6) Why the unionization rate increases wages for both union and non-union members in a firm. Based on the model in Eqs. 9.14–9.17, the firm will have a lot of weight in both of its product market and the labor market. The large number of employees is good for the firm in the sense that the firm actually creates profits out of its human resources. But, this same crowd of workers is also or could also be a problem and a source of troubles. The first reason is that when the firm is small, its workers are few in numbers and low in quality (relatively speaking, see the analysis above). So, they can be replaced relatively easily. Using the yoyo model, the small group of workers could not form a strong enough whirlpool to overthrow or severely interrupt the operation of the economic yoyo of the firm. When the number of workers reaches a critical mass and when these employees discover the lucrative cash flows in and out of the firm's bank accounts because of their work, they will see the need to take collective actions in order to share a greater proportion of the firm's profits.

This end is simulated well by the dishpan experiment, where only with enough water, asymmetric and non-uniform flow patterns will appear. This analysis explains why Dickens (1986) predicts that industries with high wages suffer from the highest threat of union actions.

9.4 Case Studies

This section is made up of five case studies. Beyond the analytic supports developed in the previous two sections, these case studies are used to illustrate the main conclusions derived on the analysis of the systemic yoyo models in Sect. 9.1.

Case Study 9.1 In this study, we will look at a historical account of Pan Am, once America's flag airliner, to see how when the dynamic equilibrium of forces in the marketplace evolves, the temporary balance of power in the ocean of economic yoyos, each company (an individual economic yoyo of the ocean) has to modify its internal structure accordingly; otherwise, the company, no matter how successful it was, would fail. This presentation is based on (Sobel 1999a, p 213–238). For relevant events and comments, please refer to (Allen 1981; Daley 1980; Davies 1987; Van Doren 1993; Velocci 1996).

At the beginning, aviation only appealed to the romantic and adventuresome because the early unsafe planes were barely faster than trains and could not carry much weight. So, other than carrying mail, nothing else seemed possible. Even so, some European countries organized airlines in the post-World War I period with major financial support from their governments. For instance, Germany had the Deutsche Luft Reederei, the predecessor of Lufthansa, and France had several lines, some of which later became the backbone for Air France. British Aircraft and Transport actually began during the war. Responding to the development in Europe, Congress voted an appropriation of $100,000 for an experimental air service for the US Postal Service, which carried mail between Chicago and New York. Calvin Coolidge, whose prime goal while in the white house was to cut taxes, slash spending, and pay off the national debt, supported aviation due to defense reasons. He signed the Kelly Air Mail Act of 1925 and an additional legislation in 1928, which provided subsidies for American carriers.

By that time, Juan Trippe had three years of experience with air transport. He initially learned how to fly during the war. Upon his father's sudden death, Juan had to work for making a living. After graduating from Yale Trippe accepted a banking post at Lee, Higginson, but was seeking for opportunities in aviation. In 1922 he met John Hambleton, a flyer in the war. They purchased surplus Navy seaplanes for $500 each and launched an airline that took people between New York and Long Island resorts as a hobby. In 1925 when the Kelly Act was passed, Trippe, together with several Yale classmates, organized Eastern Air Transport. After merging with Colonial Air Transport and taking that company's name, he won one of the first contracts and in 1926 started carrying the mail between New

York and Boston. Upon this success, he conceived of a worldwide airline, operated with the assistance and cooperation of the government. He wanted to be the flag carrier for the United States, believing that such an airline was important for America. It was because, Trippe realized correctly, the United States had emerged from World War I as the most powerful nation in the world and was eager to spread its interests in other lands. Just as transportation had been important in making the United States a continental power, it so would be essential if it were to realize its worldwide ambitions.

Analyzing the forthcoming rivalry for domestic services, Trippe imagined the need for just one international airline. And if his company became that airline, he could work out deals with politicians and not have to worry about jostling with other would-be aviation tycoons. To implement his plan, he quickly obtained landing rights in Havana, Cuba, in order to carry mail and passengers between there and Key West, Florida. Next, he tried to win the airmail contracts. Of the three bidders, Trippe's company had landing rights in Havana, Pan American Airways had them in America, and Atlantic, Gulf and Caribbean Airways had financing in place. As demanded by Assistant Postmaster General Irving Glover, these bidders merged with Atlantic becoming a holding company for Pan Am, which was to be operating company, and Trippe its president and general manager. In October 1927, Pan Am began its runs to and from Havana. To convince potential passengers that the overwater flight to Cuba was not only fast, but safe, Trippe first offered free flights and then charged for tickets when the service became popular.

In 1928 through Secretary of the Treasury Andrew Mellon, Trippe was introduced to Congressman Kelly, who at the time was drafting legislation to govern international mail policy and the awarding of contracts. By dint of skillful lobbying, Pan Am was granted an airmail contract between Puerto Rico and the mainland. In 1929, Trippe formed Panagra to expand his routes into South America jointly with W. R. Grace, who dominated the western coast of South America and was considering starting an airline of its own to complement the Grace Line steamships. Within a few years Panagra had the longest route structure among all airlines with airmail providing the bulk of the earnings. In 1929 Herbert Hoover became the president with Walter Brown serving as his postmaster general. Brown was more averse to competition than Kelly and Glover were, and awarded domestic mail contracts to American, Eastern, Trans World Airways, and United, enabling these airlines to obtain a leadership in the domestic arena. Because Trippe had strong connections with Walter Brown and Francis White of Latin American affairs in the State Department, the Americas belonged to Juan Trippe. This made the 1930s, the decade of the Great Depression, a time of major growth for Pan Am. In 1930 the company carried 40,000 passengers. And by 1940 the figure went up to 246,000. Even so, the mail contracts remained crucial.

As the next challenge, Trippe hoped to offer service to Europe. To accomplish that, he needed permissions, but the British were reluctant to grant rights. So, Trippe turned westward. In 1932 he planned to offer passenger and mail flights across the Pacific to the Philippines. The service began three years later. In 1938, the Civil Aeronautics Authority (CAA) was approved, and Trippe felt certain he

was able to sway CAA into annealing Pan Am's domination of international traffic. In order to get routes to Europe for several years without success, Trippe petitioned the Roosevelt Administration for assistance. For national security reasons, Secretary of State Cordell Hull intervened in Pan Am's behalf and worked out a deal with the British whereby that country's Imperial Airways and Pan Am would cooperate in opening the Atlantic, pooling passengers and cargo. After that, Trippe obtained landing rights in the Azores and was able to make flights to Europe in 1939. Service of loads of airmail began in June, and soon after passengers were accommodated. Also important was the CAA's willingness to allow Trippe to boost rates, as well as the opening of LaGuardia Airport in the autumn. Even so, Pan Am was debt-laden as a result of airliner purchases and Trippes' willingness to take losses on passenger travel in order to establish the service.

During the WWII, the War Department organized the Air Transport Command (ATC), which awarded contracts to different airlines, making the rival airlines competitors in the overseas business. American and Trans World flew the North Atlantic to London, while United went into the Pacific and Eastern and Braniff flew to Latin America. In 1943 the 19 airlines that had ATC contracts met in Washington and were told the government had no intention of remaining in the transport business after the war. Therefore, it was up to these executives to determine the shape of the industry. As it happened, 17 American carriers filed route requests with the Civil Aeronautics Board (CAB), which had taken over some of the duties of the CAA, and Trippe's allies there could not block them. In April 1945, together with the European state airlines that flew oceanic routes, Trippe established the International Air Transport Association (IATA) for the purpose of fixing prices and setting rules and policies, one which, as expected, was to restrict entry. Washington instantly complained that the IATA was in violation of the antitrust laws, but this was gotten around when British Overseas Airways (BOAC) agreed to permit other carriers to enter London. From then on, IATA was more important in regulating fares and practices for transnational carriers than were governments. Soon, Trans World Airlines became the first challenger the Pan Am CEO had ever had to face for the New York-to-London route. TWA had a strong national network, and was using faster land-based planes. In 1946, the first postwar year, Pan Am had revenues of $113 million and earnings of $3 million, while TWA posted revenues of $57 million and losses of $14 million.

Foreseeing the arrival of a new era in travel with airlines playing an ever important role, Trippe planned for a true global airline that would conduct business on all continents and provide for all necessities. So, starting in 1949 Trippe constructed hotels, known as the Intercontinentals, for Pan Am travelers to stay with government assistance in the form of loans from the Export–Import Bank for 90% of the hotel prices. With the arrival of the expected boom in passenger travel across the Atlantic, especially to London, Pan Am faced competition, from both TWA, the foreign airlines, and the old way of making the journey: passenger liners. These liners were offering round-trip tourist-class services for around $350, while more lavish passage cost upward of $700. To meet the challenge, Trippe obtained permission to lower air fares to under $500 from other IATA members

and the government. In late 1955 Trippe purchased jetliners, which could make crossing-Atlantic trip nonstop, by making an investment of $269 million that dwarfed all previous ones. In 1957 as a result of $450 fares for economic class, more passengers crossing the Atlantic made their journey by air than by ship. And soon, since these new planes were in service and profitable due to their faster speed and larger capacity, Trippe responded by leading IATA into new rounds of price cuts. With this, nonstop travel from New York to London became reality. By 1968 Pan Am was operating 115 passenger planes and had become an $841 million company with $72 million in earnings. Adjusted for a 2-1 stock split, Pan Am common had gone from 10 in late 1962 to 40 in mid-1966 and had the cachet of being both a blue-chip and a glamor stock.

It was then that things started turning sour for Pan Am. It began with Panagra. Before the war Trippe had tried unsuccessfully to buy out interests of his partner W. R. Grace and when that failed, he refused to permit Panagra to enter Miami and New York. In retaliation, Grace had become cofounder and stockholder in Eastern Airlines. When Eastern was unable to get landing rights, Grace formed a partnership with National Airlines, hoping to merge it with his half of Panagra. Trippe block it. In 1967 Grace sold Braniff his half, whereupon Trippe also sold that company his share. Additionally, there were two more important blows; the first one was technological in nature and the second economic. As in the late 1950s the airline industry was invigorated by the arrival of the jets, so it appeared another new day was coming with the development of the supersonic airplane, which could fly at 1,800 mph and carry 200 passengers. Pan Am was quick to sign up for 15 such planes. As it turned out no such plane was ever built. However, in time, the American and several carriers became the leader by going instead for the Boeing 747, which could carry up to 400 passengers and fly 5,500 miles without refueling. Feeling the pressure, in April 1966 Trippe signed an agreement with Boeing to take 25 of the 747's for delivery between September 1969 and May 1970 for the total cost of more than $530 million, the biggest commercial airplane sale in history. This gamble Pan Am did not have to take. However, for Trippe he was now 67 years old and wanted to make a dramatic exit from the industry. In 1967, Trippe's last year at the helm, Pan Am posted $950 million in revenues with $65 million in earnings, the former figure a record, the later second best in Pan Am history after 1966s $72 million.

Soon a decline in air travel appeared with a vengeance, indicating what a worst time Trippe had chosen to make the purchase. The economy fell into recession and airline traffic dropped, causing Pan Am lose money in the first quarter of 1968 and the red ink continued. Facing the difficulty ahead, Trippe retired and named his longtime second in command and president, Harold Gray, as his successor and Najeeb Halaby, a newcomer and Washington insider, president. Gray had cancer and lasted only a year and a half before retiring and turning the company over to Halaby. The company lost $120 million for the period of 1969–1971 plus difficulties with the 747s. So servicing the debt became a daunting task, while TWA received Pacific rights and became America's second global airline. This situation struck Pan Am at its very core, because the other Atlantic and Pacific carriers, such as TWA, United, Northwest, and American, had strong domestic routes and could offer passengers bargains

when taking them from their homes or offices outside New York to Europe or Asia. Additionally, transfers could often be arranged in the same terminal. However, such advantages were not available to Pan Am, which lacked those domestic routes. Moreover, since ISTA had lost the power to set prices as a result of deregulation, Pan Am's position in its leader no longer mattered.

Halaby had to do something to rectify the situation, and the most obvious was a merger or working relationship with one or more domestic carriers. But, nothing came out of this effort. By 1971 Halaby was talking with TWA about a merger; both airlines matched and Pan Am's Intercontinentals and TWA's International Hotels would make it a major factor in that field. Unfortunately, the plan was blocked by the Antitrust Division of Justice Department. In 1971 Pan Am was expected to report a loss of around $46 million, and there was some fear about that its line of credit might not be expanded. On December 1 Pan Am announced Halaby's replacement by William Seawell, formerly president of Rolls-Royce Aero, the American subsidiary of the English company and a former Air Force general. Seawell did as the expected. He fired employees from 42,000 when he arrived to that of 27,000 by the time he was done, which surely meant route abandonment. In 1974 the industry was hit by the increasing price of petroleum. Pan Am's losses that year came to $85 million. For the period 1968–1976 the company's total deficits came to $318 million, more than that the company had ever earned in its entire history. Then came the second fuel crisis in 1978, at the end of which the net working capital for the company was a negative $288 million.

Seawell approached National Airlines as a merger partner in order to resolve Pan Am's problems. National had a strong domestic network along the East Coast, it went into New Orleans, Houston, and was also a minor force on the West Coast. Among the negatives was an aging airliner fleet and a generous union contract. At the same time, Frank Lorenzo also went after National. He then was in the process of transforming his Texas International Airlines into a major carrier. These two companies in 1979 entered into a bidding war, which pushed the price of National common from 20 to 50, by then Eastern also entered the bidding. Pan Am eventually won for a total cost of $400 million. Then the previous 747 experience repeated when the nation was hit with another recession and much higher interest rates, causing all companies having to finance debt to borrow at rates over 20%. Plus, deregulation was the second shock to hit the industry. Alfred Kahn, a Cornell economist who for years had been arguing for the elimination of such controls and the total dismantling of regulatory agencies. He was named to the CAB in 1977 by President Carter and immediately indicated his desire to bring competition to the airline industry that had been previously non-competitive by inviting all airline to apply for discount and special fares. He also pressed for legislation to make it easier for new carriers to become certified. Kahn deemed his job as to protect competition, not companies.

Under Kahn's aegis the Carter Administration freely awarded routes to other carriers, so Delta got Atlanta to London, National Miami to Paris and Amsterdam, and Northwest could fly into Copenhagen and Stockholm. Foreign airlines also obtained rights so that more KLM, British Airways, and Lufthansa flights arrived. Freddie Laker, whose British charter airline had applied for permission to operate

"Skytrain" with inexpensive fares between New York and London, received CAB approval. Laker's no frills operation was a huge success, and other similar lines appeared in both domestically and overseas markets. Pan Am and other IATA members responded by cutting their fares to his level, but Laker continued to grow and others joined in. Then came passage of the Airline Deregulation Act of 1978, which ended regulation of domestic air fares and further eased entry for new carriers.

With the new environment most of the old airline executives were unable to cope except for American. Its executive Robert Crandall not only had a proper and realistic vision of the future but also the nerve to create and implement a winning strategy. As it happened, Crandall had the kind of experiences airline executives needed in this period. He formed an alliance with IBM to produce the Semi-Automatic Business Research Environment ticket-reservation system, which gave American the lead in three major areas: discount fares, management of pricing, and filling empty seats. Crandall also introduced the frequent-flyer program, Advantage, the first in the industry. Under his leadership American adjusted nicely. On the other hand, in early 1980 Pan Am was clearly in trouble with its bonds downgraded and its stock selling for $4 a share. To survive, Pan Am sold the Pan Am Building in New York City to Metropolitan Life for $400 million, at the time the highest price ever paid for Manhattan property. Its banks canceled its $470 million line of credit. In August 1981, Seawell resigned and was replaced by William Waltrip, the company's executive vice president. Waltrip served as an interim while the board searched for a permanent replacement. Soon Waltrip announced a major corporate restructuring. Under a single corporate umbrella there would be three Pan Ams: Pan American World Airways, which would be Waltrip's responsibility; Intercontinental Hotels, to be headed by Paul Sheeline; and Pan Am World Services, managed by Thomas Flanigan. Immediately, even before Sheeline took office, Intercontinental Hotels was sold to Grand Metropolitan for $500 million. Airliner purchases were canceled or postponed. Pan Am's debt was downgraded, and its subordinated bonds fell to junk status.

That summer Pan Am's next leader C. Edward Acker was selected. He had been president of Braniff and more recently had transformed Air Florida from a minuscule factor of the industry into a regional power. Acker tried to infuse optimism in Pan Am, but it was too far gone by then to be saved. In 1982, Pan Am reported a loss of $495 million with working capital at negative $340 million. The unions agreed to wage freezes, and management also accepted cuts in salaries. Next Pan Am started disposing of parts of its fleet, and soon the routes went. Then there was a crippling pilot strike in 1985 that pretty much had the company finished. For all the while intense competition from European airlines hurt Pan Am on its Atlantic routes; and the strong dollar made it difficult for Pan Am to compete on a price basis.

In 1987 the union of Pan Am's pilots searched around for someone to come into save their jobs, while the board was seeking a replacement for Acker. They found the ideal man in Thomas Plaskett, who once headed Continental, and who arrived in January 1988. As a miracle, under the new leadership Pan Am turned around.

By summer Plaskett was predicting a modest profit and a positive cash flow. Then, on December 21, Flight 103 was blown up over Lockerbie, Scotland, for reasons beyond Pan Am's control. Although such disaster could happen to any airline, how Pan Am handled the aftermath really determined the fate of the company. In particular, the airline released wrong telephone numbers for family members to call; one family was informed of the death of their daughter by a message on their answering machine. Some of the families that telephoned were put on hold, while listening to the song "I'll be Home for Christmas." Pan Am advised the media that all the families had been notified when this was not true. So it went, with one mistake after another; and in the process Pan Am lost all of its credibility and sympathy it might have had from the public. Finally Pan Am filed for Chap. 11 bankruptcy on January 8, 1991 when the airline industry in the aggregate lost $6.5 billion in 1990–1991. At the end, it emerged as a Miami-based airline with flights going to Latin America. It was back to where it had been when Juan Tripped started out.

This presentation very well indicates that when the dynamic equilibrium of forces in the marketplace evolves, the temporary balance of power between economic yoyos develop accordingly. Therefore, the relevant companies in the marketplace have to modify its internal structure accordingly; otherwise, the eventual failure would be the inevitable consequence. For instance, after Pan Am was gone, Delta became a powerful force in the Atlantic due in large part to its acquisitions of Pan Am's business in that part of the world. Other than that, Delta obtained greater might by allying itself with Swissair, Sabena, Aer Lingus, Austrian, Aeromexico, TAP Air Portugal, and others. Similarly, United formed alliance with, among others, Air Canada, Scandinavian, Varig, Lufthansa, Thai Airways International, and Singapore. American, which first joined with Canadian, British Airways, LOT, and Qantas, then formed an alliance with U.S. Airways and British Airways. And Northwest tool control of Continental. That is, in the evolution of the industry, while some were destroyed by competition, others were getting stronger and becoming more powerful. That is the rule on how the ocean of spinning yoyos works.

Case Study 9.2 In this presentation, we will look at the development history of Radio Corporation of America (RCA) in order to confirm the fact that when a viable economic yoyo stops its rotation, it will cease to exist and its parts will be taken by other spinning fields. What follows is based on (Sobel 1999a, p 65–86). For relevant events and further analyses, please consult with (Dreher 1977; Lyons 1966; Sobel 1996).

David Sarnoff arrived in America as a poor Russian immigrant boy. He left school to earn a living for his family. Like most with his background, Sarnoff had a mania to succeed. Other than being vain, arrogant, and a bully, Sarnoff was also a farsighted businessman, a superb manager, and a clever tactician. For instance, in 1915, as an assistant traffic manager for the Marconi Wireless Telegraph Company, Sarnoff pushed for the development, production, and mass marketing of the radio music box with the prediction that the sales would eventually reach $75

million. However, Marconi's management did not accept the plan. So, when the company was reorganized as RCA, David jockeyed himself into such a position that he could put his ideas into action.

At the start, RCA was jointly owned by GE, ATT, Westinghouse, and United Fruit; it was supposed to become the American entry in the international struggle to dominate wireless communication. Then, Sarnoff led RCA into the broadcasting industry through National Broadcasting Network (NBC). He negotiated the company's independence from its owners, and took RCA into phonographs and records, motion pictures, talent agencies, and a host of related businesses. By the 1930s RCA had become the giant of the glamorous and profitable entertainment industry with the largest profits and greatest promise. David Sarnoff and RCA in the early 1930s were the Bill Gates and Microsoft in the late 1990s.

There were many failures in David's career. For instance, he thought of reinvesting air conditioners that might be hung on walls like pictures, eliminating the plumbing and electrical complications of the existing models. He also pioneered FM radio, and cut back sharply to devote RCA's resources to television. RCA's 45 rpm phonograph players and records proved duds and were abandoned as the nation took to Columbia's 33 1/3 version. Even so, none of the failures seriously hurt RCA; on the contrary, they were tributes to the company's attempts to pioneer with new products. In 1955 RCA's revenues topped $1 billion, almost twice those of IBM and three times those of arch-rival CBS. By the late 1950s, David was at the peak of his career while RCA was one of the most admired corporations of the world.

It was then that David, at the age of 64, had overreacted with two switches in corporate strategy with scopes as ambitious as his earlier move into television, transforming the existing businesses into cash cows that had financed other new ventures. One part of David's two-pronged strategy was the foray into computers. Given RCA's resources and history, such a move was natural and sensible. The RCA Research Center was a showplace and one of the top technological centers in the world, more prestigious than its IBM equivalent and the equal of the Bell Laboratories. In 1956, as IBM was gaining a dominating share in the civilian markets, it seemed that RCA had a leg up in the military area.

Since young, Bobby Sarnoff, the eldest son of David, boarded at a prestigious private school, and then entered Harvard in 1935. Personable and uninterested in science, Bobby considered becoming a public-relations man. However, David nixed the plan. He liked one of his sons to be a lawyer and another engineer. Bobby was not pleased with the idea of becoming a lawyer, but agreed to try. After dutifully attending Columbia Law School for a year, he left for naval duty during World War II. After his discharge Bobby worked as an advertising man and then assistant to Gardner Cowles, publisher of the Des Moines Register and president of Cowles Broadcasting, in order to break away from his father. However, it was David who got him both the job and the promotion. David wanted Bobby to have some experience in broadcasting. Bobby returned to New York in 1946 as an executive for Look magazine, and two years later he became an account executive at NBC. During the next few years Bobby moved up the ladder at NBC, being

trained under a series of executives. By 1953 he was an executive vice president under Sylvester Weaver. Two years later, when Weaver was elevated to the chairmanship, Bobby became president of NBC. Soon, Bobby became the chairman of the network, replacing Weaver. What should be noted here is that Bobby was not playing at the center of power of RCA. He was located at the network, receiving orders from headquarters. So he had no practical experience in running the parent company. That is, somehow David did not think Bobby was up to the demands in the central executive suites.

The second part of David's strategy was conglomeration or diversification into nonrelated areas. According to ITT's Harold Geneen, conglomeration enabled that corporation to weather economic storms by balancing cyclical against growth holdings, marrying cash cows with capital-short companies, foreign and domestic businesses, service and manufacturing, and etc. And within the industry conglomeration was known to be opportunism, the search in whatever places for profits. So, in the last years of his stewardship at RCA, David nibbled at Random House, which under Bennett Cerf had become one of the nation's premier publishers. Cerf was a panelist on the TV program "What's My Line?" on CBS, a nationally recognized figure, and one of the shrewdest CEO's in the publishing business.

In January 1966 David steeped down as RCA CEO, leaving behind a superb corporation with a handsome legacy. The TV business and the network were throwing off large amounts of cash, as were several of the ancillary businesses. The other consumer electronics products were doing well. Random House was not delivering as promised, but it was profitable. Taking David's place came Elmer Engstrom, a competent veteran of RCA since 1923. He promised to prepare Bobby for the job and would step down as soon as Bobby was ready. Engstrom had a five-year contact, but left in two with Bobby taking his place as everyone expected. Now 75 years old, David remained as chairman of the board. During the first years as the company's CEO Bobby was eager to make his impact but uncertain about what he should do. He wanted independence, but at the same time also yearned for the security created by his father's approach. For instance, Bobby sold the marine-radio operation, the original business of RCA, so that he cut the tie to the David's era; and the ventures into medical technology and electronic microscopy, which intrigued David before, were dropped. As chairman, David made no secret of his distaste for the evidence of Bobby's rebellion.

Other than making mostly cosmetic changes, Bobby was content with managing his inheritance and went along the same paths his father had set earlier. The trouble with this was that along with changing business climate Bobby did not seem capable of recognizing shifts. For example, for the RCA's computer business, even after mounting losses and warnings of mismanagement reached his ear, Bobby still plowed ahead without making any adjustment in terms of either the pace or direction. As for the conglomeration, it was more intriguing. Deciding to start big, Bobby went after a giant, Hertz, the leading firm in car rentals, and paid for it with stock worth more than $200 million. Different from the case of Random House, this one was true diversification. In 1968 Bobby went after St. Regis Paper,

a $721 million cash-short giant. Why St. Regis? It was because it would catapult RCA into the ranks of the top-ten American corporations in terms of size and would provide Bobby with instant status of a kind. St. Regis was a troubled company. Fortunately for RCA, this one did not go through. Undeterred Bobby purchased F. M. Stamper, a leading packager of frozen foods, for $141 million in common stock. He then obtained Cushman & Wakefield, a New York-based real-estate company. Bobby next made a pass at Loews, which was a huge conglomerate based on hotels, tobacco, and real estate, which he intended buying for stock. But the deal was turned down by the CEO of Loews.

In 1969, RCA's computer division shipped a good number of mainframes that were worth more than a quarter of a billion dollars, many of them purchased by the parent company for leasing. However, the lease records were not kept in any orderly fashion. The auditors could not locate what was needed; executives came and gone; the company did not even know whether any particular machine was actually making money. By 1970 the division was spinning out of control. RCA executives hunkered down, each protecting his own turf. RCA was no longer a centrally controlled and coordinated corporation, but instead a confederacy of divisions with little relationship to one another. In 1970 RCA's net income slid from $161.2 million to $91.3 million, while its debt rose to $973 million, more than tripled that of 1966. RCA common had been sold for 65 in 1967; it was below 20 in the summer of 1970. Then Bobby sold RCA's computer division to Sperry Rand for $127 million, from which Sperry's UNIVAC division took over a customer base of 500 companies and government agencies that by itself was worth more than the paid price. Additionally, UNIVAC received more than 1,000 RCA computers on lease, which had cost more than $900 million to RCA. Most important, UNIVAC obtained a fine technological team. RCA took a half-billion dollar write off in 1971, which reduced the company's net worth by a quarter and made Bobby Sarnoff lost all of his credibility. Rumor had it that RCA was close to illiquidity.

What was more important than what had happened was that the botch caused RCA's leaders to lose their nerve, which exaggerated RCA's problems. Although Hertz and broadcasting were doing well, consumer electronics, once the company's biggest moneymaker, was sliding drastically. By 1974, profits from color-TV market had declined to $11.1 million from the $53.7 million of 1971. Now, RCA earned more from Hertz than from consumer products. Bobby hoped to reverse this trend with new electronic products, but nothing came out successfully due to his unwillingness to make the necessary investments. The emphasis was on getting into a new business for as little as possible and making a buck as fast as you could. In retrospect, had David conducted his business this way, RCA would never have gone into either broadcasting or television; and there might never have been an RCA. However, Bobby and those around him were now mesmerized by fears of failure. The computer venture cost $2 billion pretax; that loss took away the management's courage to take on any major new projects. Consequently, Bobby's RCA now made many half a dollar bets by acquiring small companies,

hoarding cash, and trying for short-term income enhancements, such as selling technology and RCA's patent rights.

In the sector of color TV, by 1974, RCA's market share had shrunk to 20%, due to market competition and declining quality. Eventually, RCA departed that market entirely by selling sets manufactured by others by simply slapping on the RCA logo. Crushed by criticism and struggles for power within the company, Bobby became increasingly moody and withdrawn and suffered from health problems. In October 1975, while Bobby was away with his wife on a tour, the RCA board met and replaced him by Anthony Conrad, an RCA veteran. Soon, Conrad stepped down voluntarily due to tax irregularities. Into RCA came Edgar Griffifths, a dynamic person who expanded RCA's conglomerating efforts and brought up revenues and profits. After losing about half a billion dollars on the delayed introduction of the videodisc, known as SelectaVision, Griffifths left the company in late 1981 to Thornton Bradshaw, the smooth, well-connected former CEO of Atlantic Richfield and an RCA board member. For Bradshaw, his goal was to sell RCA to a high bidder, which turned out to be General Electric. In 1986 GE took RCA in for the price of $6.3 billion, with which RCA passed from the scene.

Case Study 9.3 To show historically how small yoyos are bullied or destroyed by larger systemic fields, as depicted visually in Figs. 9.4, 9.7, and 9.9, in what follows in this case study we will look at Henry J. Kaiser's failed attempt of entering the automobile industry during the post WW II era. This part is based on (Sobel 1999a, pp 45–64). For relevant discussions, please consult with (Adams 1997; Anderson 1950; McShane 1994).

Henry Kaiser was a wonder-maker to his generation of Americans during the first half of the twentieth century. At the peak of his career, Kaiser epitomized the best of American business during a time of economic troubles and then in the difficult years of WWII. Many entities carried his name, such as Kaiser Steel, Kaiser Aluminum, and Kaiser Ventures. The Kaiser Permanente was founded in 1945 as a way to keep his employees at his Permanente cement plant healthy. Later it is recognized as one of the country's oldest, largest, and most successful health-maintenance organizations.

Henry was born in a German immigrant family. His father was a mechanic, and mother a practical nurse. In 1985, toward the end of the worst depression up to that time, the 12-year-old Henry left school to become a $1.5-a-week clerk at a nearby dry-goods store. From there on he bounced from job to job winding up in 1912 as a salesman and manager for the Hawkeye Fuel Company of Spokane, Washington, a gravel and cement firm that was involved in road construction. Two years later, he left Hawkeye and formed his very own highway construction company, the Henry J. Kaiser Co., and started bidding on highway contracts across the border in British Columbia. Through first-hand experiences, he brought in various projects on a timely fashion usually on or below budget so that he was able to keep his work crews together in an industry where layoffs were common. Consequently, by the mid-1920s he had attracted some of the ablest individuals in the industry to his company.

His successes helped him to formulate the motto that "find a need, and fill it," while he was totally convinced that there was no task he could not accomplish. For instance, during the summer of 1942 when Axis submarines were sinking American ships in alarming numbers, Kaiser went to Washington and offered to construct a fleet of 5,000 cargo planes, which would lessen the reliance on cargo ships. What did he know about airplane industry? Nothing! But he was never deterred by his personal ignorance or limitations on his part. Upon the rejection of his plan, Kaiser instead entered the shipbuilding business without knowing much about ship construction, either. Backed by the Reconstruction Finance Corporation (RFC), he formed an alliance with John David Reilly, president of Todd Shipyards. Eventually Kaiser managed seven shipyards, producing close to one-third of America's production.

Also in 1942, Kaiser constructed the first complete steel plant in California, which produced over one million tons of ingot steel during the war and later became the largest steel producer west of the Mississippi. The following year, he entered the warplanes business by purchasing Fleetwood Aircraft. In 1944, he added gypsum and magnesium to the mix. He also dabbled in helicopters, ferro-silicon, and insurance. Kaiser was so much of a war hero that after the victory in Europe, General Eisenhower invited Kaiser to tour Europe in order to let the troops meet the man who had done so much to help win the war.

In the Spring of 1945, after learning about Kaiser's ambitions in automobiles and hoping to provide jobs for workers dismissed from war-related industries, Rolland Thomas of the United Auto Workers wrote to Kaiser:

> If you were truly serious about entering the auto business, you might consider making a bid for the huge Willow Run plant just outside Detroit. The facility was owned by the government and at the time operated by Ford to produce B-24 warplanes. Ford would not need the facility after the war, and it could be easily converted to auto production.

For Kaiser, however, what he needed was an automotive equivalent of Todd Shipyard's John David Reilly, whom he found in Joseph Frazer. Frazer was a well-respected and shrewd automobile pioneer who had served at several companies in a wide variety of posts except production.

At roughly the same time period Joseph Frazer had his plans for the postwar market, including a new car that he wanted to call the Frazer. In July, while Kaiser was considering Willow Run, Frazer had a meeting with A. P. Giannini of the Bank of America, the most powerful West Coast banker, to present his plans. That happened to be the time when Giannini was visualizing an automobile industry in California, headed by Kaiser and financed by the Bank of America. Frazer did not like the idea of joining hands with Kaiser due to personality differences, because Kaiser fairly bubbled with enthusiasm and was willing to try anything, while Frazer was a natural salesman and was more reserved and conventional, and both somewhat were imperious and unwilling to play the second fiddle to anyone. However, to satisfy his desire to expand, Frazer gave in and accepted the proposal. On August 9, Kaiser-Frazer was incorporated, jointly owned by the Henry J. Kaiser Company and Graham-Paige, so that the Kaiser would be produced on the West Coast, while the Frazer out of the Graham-Paige Detroit operation.

Considering the special point in time, both men had every reason to expect success. In 1945 half of the 25.8 million cars on the American roads were more than ten years old and most of them well beyond their useful life. Every week, thousands of cars dropped dead along the roadside. That was the golden opportunity that lured both Kaiser, Frazer, and their banker A. P. Giannini. The expectation of the time was that every car produced during the next three to six years would be snapped up by eager buyers. It indicated that Kaiser-Frazer would be able to count on strong sales at least till 1948, by then both men thought they would be established, entrenched, and profitable. However, opposite the rosy outlooks, Kaiser-Frazer would have to fight against some stiff competition from the Big Three, GM, Ford, and Chrysler, which before the war had 90% of sales, together with other independents, such as Studebaker, Nash, Packard, and Hudson, which had loyal followings of their own. All these companies, of course, had their individual plans for the postwar market. They uniformly agreed that the public wanted pretty much the same as what they had before the war: inexpensive, small cars for the multitudes, ponderous, large ones for the affluent.

Going against the trend, Frazer's strategy was to come to the market as rapidly as possible with genuine postwar cars, which were different of the revamped prewar models Detroit was planning. Together Kaiser and Frazer made plans for their new cars, the facilities at which they would be produced, and the distribution network to take them to potential buyers. With the financing of RFC and corporation of the UAW, which called for a strike at GM, Kaiser-Frazer got on their way smoothly with Kaiser serving as the chairman, company spokesman, and arranging financing, and Frazer the president in charge of day-to-day operations. Giannini promised a $10 million line of credit, Kaiser-Frazer would issue 2.2 million shares of common stock to raise $17 million. Although in 1945 the public was still wary of common stock, memories of the Great Depression were fresh in everyone's mind, and at the time a $17 million initial public offering seemed awfully risky to the district's timid bankers, Cyrus Eaton, who headed Otis & Co., a Cleveland bank, agreed to underwrite the issue and took it public in September. To the surprise of all involved, the public offering was a great success.

The performance reports on the Kaiser and the Frazer were optimistic. Three days prior to the offering in 1946 a crowd of about 156,000 shuttled in and out of showrooms at New York's Waldorf-Astoria at Kaiser-Frazer's preview; and nearly 9,000 of the visitors plunked down deposits without knowing either the cost or the delivery date. And an initial 800 dealers were selected, and many of them were at the car show. The show boosted the price of Kaiser-Frazer stock to $17 and soon after to $24, a sign of confidence in the two men. Then, the company started to advertise its cars by stressing that they were no warmed-over models; instead they were new from wheels up combined with new designs and engineering advances.

By early April customers had put down deposits for close to 400,000 Kaisers and 270,000 Frazers, and still not a single car had left the factories. In June, seven cars were produced, then the pace quickened so that the company turned out 11,763 for all of 1946. The initial New York shipment arrived on June 29, provoking a mob scene at Regional Auto Sales in Manhattan. The basic Kaiser

listed for $1,898 and the Frazer at $2,053. These higher prices were due to deals Kaiser had to strike with suppliers, who knew Kaiser-Frazer had to take whatever it could get and so extracted premium prices. Besides, Kaiser-Frazer got some of its steel from Kaiser Steel on the West Coast with expensive transportation charges. As estimated, Kaiser-Frazer paid a 40% premium for the rest of the hard-to-get steel it ever purchased. Such costs plagued the company during its entire existence. Additionally, the Kaisers and Frazers did not have automatic shifting because GM refused to sell Kaiser-Frazer its hydromatic drives. The company could not successfully acquire eight-cylinder engines from any supplier at a time when these were becoming increasingly popular, going from 20% of the market in 1947 to close to 30% in 1951. When Kaiser-Frazer was finally able to purchase automatic transmissions from GM, it was too late to do much good for the sales. Even with all these difficulties, the Kaisers and Frazers performed as promised; no serious mechanical glitches appeared other than some complaints about being underpowered. But this did not seem a major problem.

For 1947 the company produced 144,000 vehicles. Although the figure was far below Chrysler and Ford, and was only one tenth of that for the industry-leader GM, Kaiser-Frazer showed a profit of $19 million for the year, which matched the losses due to start-up expenses in 1946. It was considered another industrial miracle from the workshop of Henry Kaiser that the company did so well so quickly. By this time, Detroit had retooled and the older companies were offering models that were at least as fresh and technologically advanced as the Kaisers and Frazers, while the Kaiser-Frazer engines remained a problem.

In 1948, as the shortage of cars vanished, the dealers' incapabilities of selling the newly produced 181,000 cars of the year started to surface. What happened was that by then Frazer had taken on 4,000 dealers. Though Frazer had made his reputation in sales and the industry thought he must have put together a fine team, as it happened, the dealer organization was decidedly second rate. Those Kaiser-Frazer dealers who initially were only order-takers, now had to engage in selling, a task at which they proved inadequate. When sales started to decline, Kaiser lost confidence in Frazer, while Frazer pointed out Kaiser's deficiencies. Making the situation worse, in this period there were a series of strikes at Willow Run. Those workers' demands accelerated as they realized the continued prosperity, while their productivity declined. At the end, Frazer stepped down as president to be succeeded by Edgar Kaiser. In 1949 Kaiser cut prices and introduced new models, but nothing seemed to work. Production that year came to 58,000, and there was talk of insolvency.

After introducing Kaiser's new car, the Henry J., in February 1950 with a price tag of $1,299, about $50 less than the most inexpensive Chevy, the sales went up briefly for three months and then the public interest faded. To counter the decline in sales, Kaiser entered into a deal with Sears Roebuck so that the Henry J. would be sold in Sears stores as the Allstate. However, the move backfired. With good reviews from the enthusiast magazines and Consumer's Union, the newly designed Kaiser immediately caught the public's attention and the sales picked up sharply. However, in terms of profits there was none. For 1950, the second best year when

151,000 cars were sold, Kaiser-Frazer lost $13 million. In comparison, Hudson sold 144,000 cars for a profit of $12 million.

Then, the entire industry suffered from a cyclical decline in 1951 and 1952. Kaiser-Frazer continued its losing trend. In 1953 when the industry as a whole recovered, Willow Run was talking once more about bankruptcy. The renamed company, Kaiser Motors, was in desperate need of financing. But, given the status of the company, that was impossible. In 1954, a record year for the industry, only 17,000 cars were produced by Kaiser Motors. And in 1955 the figure went down below 6,000. Then it was over other than some minor overseas operations and some at the Willys unit in the United States.

From the presentation above, it can be clearly seen how Kaiser-Frazer failed. Other than problems with its management and labors, the company was bullied and destroyed by the market competition. In particular, its cars did not have the adequate technology, cost too much to make, and was consequently priced too high. The company lacked the needed quality of dealerships for its cars to effectively reach the targeted market segment.

Case Study 9.4 In what follows, by studying the development history of W. R. Grace, we will look at how in the evolution of economic yoyos, which are struggling for survival and fighting for greater market share, the available resources, and profit opportunities, some intrinsically fit yoyos would evolve into bigger and mightier entities. This presentation is based on (Sobel 1999a, pp 87–106). For relevant studies and discussions, please consult with (Drucker 1995; Kolko 1977; Sobel 1997).

W. R. Grace was founded by William Russell Grace. Although it was not a particularly large company in the early days, the firm was well-known and highly respected. The history can be traced to the potato famine of the 1840s when William left Ireland and bounced around the world as a sailor. In 1851 he shipped out to Calleo, Peru, then in the midst of a boom in the guano trade, and after a brief apprenticeship, William entered that business. Other than harvesting and sale of bird droppings as fertilizer, he also had many other interests. William was bold in vision and daring in execution. He would go wherever profits were to be made by either purchasing or founding projects and then discarding them when they lost their glow. In 1885, he organized W. R. Grace & Co. as the vehicle to channel most of his business efforts, which included Peruvian textile mills and sugar estates, a rubber industry in a Brazilian jungle, and a nitrate business in the Chilean desert. There were Grace-constructed railroads in the Andes. Also, William introduced American agricultural and electrical equipment to the west coast of South America. He was even involved in a scheme to dig a canal across Nicaragua that preceded the Panama Canal. When Peruvian finances were in shambles, William and his brother, Michael, were asked to help reorganize them and put the country back on its feet. He was concerned with politics on three continents. While deeply involved in South America, he pursued holdings in other parts of the globe. For instance, he founded Grace Brothers & Co. of London and then went on to the Orient. Within two decades, William had accumulated such a range of trading

interests that stretched from Peru to Tokyo and from the Baring Sea to the Straits of Magellan.

William relocated to New York in 1865 and later became the first Catholic mayor of the city. Upon leaving politics, he returned to business. In 1898, WR suffered a stroke and he hurt himself in a fall two years later. By then he had prepared the way for the change in command. Michael Grace and nephew Edward Eyre had been trained to take over, and Eyre became president. Behind them were William's son, Joseph Grace, and D. Stewart Iglehart, his right-hand man. William died in 1904. One of the keys to William's success, in addition to his intelligence, perception, and ability to work astonishingly long hours, was his uncanny talent for selecting and training good managers. During his time, communications were poor. So, managers had to have great responsibilities in decision making. William did not give them independence until they had proven themselves under experienced, trusted veterans. The executives he trained were expected to take the company to new heights after he passed through the scene.

In 1936, as in WR's day, W. R. Grace was still involved in a wide variety of business activities with South America. Its ship agency operated in 30 or so ports. The firm owned and operated tin, wolfram, lead, and zinc mines along with textile mills, sugar plantation together with refineries, a paper plant, cotton mills, woolen mills, and a facility that produced caustic soda, chlorine, and muriatic acid. It involved in an oilseed operation, a coffee plantation, and a trading business in East Indian coffee and cocoa. The Grace bank was seen as the savviest financial institution in its niche. The Grace line was one of America's most renowned carriers, taking cargoes and passengers to and from the United States to ports along the west coast of Latin America. Panagra, a joint venture with Pan American, was the major air carrier from the United States to points south. A popular radio program of the time, Nights in Latin America, spun visions of the exotic southern continent, along with playing native music. Grace offices were populated by men more familiar with the Cordillera de Andes than the Rockies.

After graduating from Yale, Peter Grace started his career by working in the mail room for W. R. Grace, although he did not show any discernible intellectual curiosity and interest in the business. His father, Joseph Grace, was the W. R. Grace CEO. He was a competent leader and kept paying fat dividends to Grace heirs, who depended upon the company for their incomes, and weren't about to permit anyone like Peter to inherit the mantle in order to preserve their inheritance. On the other hand, Peter was obligated to follow the rigorous training regimen by moving from one division to another, from one location to another. In the Grace tradition, he was to become a generalist and to develop the necessary commitment to the business. In 1940, Peter traveled to Chile, where he met Raul Simon, the head of W. R. Grace's Chilean operations. Simon was one of the very few intellectuals among Grace executives. Peter and Simon had a series of conservations that started Peter thinking about the company's future, as Simon predicted the United States would enter the European war then raging. Latin American countries would sell a great deal of raw materials to the United States and come out of war quite prosperous. Simon believed demagogues would come to

power throughout Latin America, promising the people endless prosperity. In time all foreign investments would be taken over, while inflation would destroy values. So, Peter was convinced that the company would have to leave South America before this happened.

As what Simon predicted, South American countries were sending increasing amounts of raw materials to the United States, creating enormously profitable for W. R. Grace. In 1938, the last full year before the war, the company generated $1.7 million in revenues, three years later the figure came to $9.1 million, and reached $12 million in 1945. Seeing much of what Simon predicted came true, Peter had developed a three-part plan:

(1) Take the company out of South America;
(2) Unearth other businesses for it to enter by either starting companies or purchasing them. The needed expertise and knowledge to operate the newly unearthed opportunities have to be obtained from the acquired companies. And,
(3) Transform W. R. Grace into a public company so that raising funds would become easier and that stock options could be employed to keep and attract the needed talents.

In the year of 1945, Joseph Grace died. After a brief struggle, Peter became the president of W. R. Grace with limited authorities and was monitored warily by the board, consisting of extended Grace family's elder statesmen and conservative family members. Many of the board members had watched Peter grew up and still thought of him as a playboy. To carry out his three-pronged plan, Peter had to move slowly and deliberately so as not to upset any of the board members and interrupt the existing operations. When a board member retired or died, Peter would replace him with new blood who agreed with his vision for the company. It surely was a difficult uphill climb. Although Peter was able to update the company's antiquated accounting system and hire new executives, he had less success convincing the board of the need to adopt his strategy. In 1952 just before Peter started his planned diversification, he was in a car accident and hospitalized for three months. During the difficult time, the board tried to fire him with his number two man, Andrew Shea, going after him. Shea did not want the diversification and neither did some of the directors. With Peter surviving the challenge, the board reluctantly agreed to a public stock offering by just one vote. W. R. Grace was listed on the New York Stock Exchange in early 1953.

For the desired diversification, Peter narrowed his search to three possible and promising areas: petroleum, chemicals, and electronics. Due to the level of risk associated with exploration and the high cost for refining, petroleum was erased from the list. For electronics, it was exciting and fresh, but evolving too rapidly. Additionally, no one on staff knew how to evaluate personnel or companies. As for chemicals, it was a large, diffuse field with many players and abundant opportunities. Some of W. R. Grace's old businesses, such as caustic soda, muriatic acid, and chlorine, could be considered parts of this wide field. Because Peter did not

know much about chemicals, he used his connections to acquire the proper talent. Into the company came retired General Electric CEO Charles Wilson, Ben Oehlert from Coca-Cola, and Robert Haslam from Standard Oil of New Jersey, who were followed by more executives and scientists. Because he could not lure the prominent people into his new venture, Peter took on a group of bright younger men who had to learn about chemicals on the run.

With the guidance of Haslam, Peter acquired Davison Chemical, whose fertilizer and insecticide complemented W. R. Grace's capabilities in these areas in South America and also had a strong position in the catalytic field. Acquiring Davison provided W. R. Grace an entry into petrochemicals, an area Peter and Haslam considered most promising. Then, Peter approached Dewey & Almy at the urging of Haslam, because D&A had a product called cryovac, which first appeared in 1949 with indifferent success; cryovac was primarily used for bagging turkeys, however in 1953 it was taking off for other uses. Additionally, D&A was a pioneer in the packaging of coffee and beverages and some interesting work on insulators. After acquiring that company, Peter went on the prowl for other deals in chemicals by investing more than $250 million during the first ten years. In 1950 the chemical business represented 3% of the company's assets, while by 1957 the figure had grown to 55%, making W. R. Grace one of the ten largest chemical companies in America. And in the same time period, revenue rose from $265 million to $460 million and earnings from $8.5 million to $15.5 million.

In 1957 recessions struck the United States and much of South America, along with which Peter had to fight against the critics who wanted him ousted. As the economy recovered, W. R. Grace prospered once again. This experience was later repeated several times, as the business of the company became quite cyclical.

Case Study 9.5 According to the property of systemic yoyos that like polarities repel and opposite attract, it is analyzed in Sect. 9.2 for Figs. 9.4, 9.7, and 9.9 that when a small yoyo is absorbed into the field of a giant yoyo structure, if the receiving field and the small yoyo do not spin in the same direction, then the small yoyo will be torn apart into pieces. In the following, we will see what could happen if these two fields that are attracting each other were of roughly the same intensity by looking at the disappearance of the Penn Central in the year of 1970. This presentation is based on (Sobel 1999a, p 189–212); and for relevant discussions, please consult with (Carson 1971; Daughen and Bitzen 1971; Heppenheimer 1993; Salisbury 1982; Stover 1970).

As dictated by the market condition, on November 1, 1957, the Pennsylvania and New York Central announced that they had decided to study the viability of a merger. If it happened, the merger would be an important symbolism for the railroad industry. The economics would be impressive: The united the new company would have $5 billion in assets, making it the tenth largest American company, $1.5 billion in revenues, and would carry 80 million passengers and 378 million tons of freight annually.

The Central was an important carrier of manufactured goods and coal with railroad lines extending southward. The company had been in poor financial shape

as recently as 1954, when it was drowning in debt. In desperation, the Central's CEO, Robert Young, turned to Alfred Perlman who agreed to become president. Perlman was one of the most highly regarded railroad men with degrees from MIT and Harvard Graduate School of Business. From the start, Perlman knew that it would be difficult to turn the Central around and suspected that his real task was to whip the railroad into shape so that it would make a plausible merger partner. Within three years that was what he did. He dieselized locomotive fleet, expanded and modernized the freight cars, and raised the dividend. In 1956, the Central reported $39 million in earnings on revenues of $780 million. Then, the recession of 1957 hit making the Central on its way down once again.

In contrast, the Pennsylvania appeared in good shape. Its CEO James Symes was 60 years old in 1957 and a great leader with rich experience with the line and the industry and a profound understanding of its problems. In 1956 the Pennsylvania reported $41 million in earnings on revenues of $991 million. Under the leadership of Symes the Pennsylvania had worked out alliances with several railroads and controlled the Norfolk & Western, which was one of the "Pocahontas" bituminous coal roads that served the West Virginia and eastern Kentucky mines. Bituminous coal was used in power generation, and its market was good and expanding, making the line highly profitable. Stuart Saunders, the Norfolk & Western's CEO, was seen as the heir to Symes at the Pennsylvania. Saunders, a graduate of Harvard Law School, left the actual operation of the Norfolk & Western to others, and devoted himself to strategic planning.

From realizing that the Central could not survive on its own, Perlman attempted unsuccessfully to enter various mergers with different regional lines before he approached the Pennsylvania. In terms of personalities, Symes and Perlman did not particularly care for one another, but they respected the other's ability and knowledge. However, for Saunders, it was a different story. Before he even met Perlman, Saunders resented Perlman's attempts to muscle his way into mergers with other firms and viewed him as an outsider and an arrogant newcomer to eastern railroading. At the same time, Perlman did not think of Saunders highly for his competence. As far as he was concerned, anyone could have amassed a good record at such a sound line as the Norfolk & Western. To further complicate the situation, David Bevan, chairman of the Pennsylvania's finance committee, disliked Perlman but shared his contempt for Saunders and had spoken openly of his feelings.

Other than the problems of personality there were other matters in such a merger. In particular, the two lines had different forms of organization, where the Pennsylvania had a divisional structure, in which branch managers had a large degree of autonomy, while at the Central their departments were managerial rather than administrative. In other words, from the New York office the Central's officers were responsible for a single department throughout the railroad, while the Pennsylvania's managers in the field took charge of a geographic area. Additionally, their billing and accounting methods were different with incompatible computer systems.

As Saunders prepared to take over the Pennsylvania's mantle, he strategically planned, among others, to dispose most of Pennsylvania's large holdings in other railroads, including the valuable block of stock in the Norfolk & Western, to raze

Pennsylvania Station in New York City and then create a New Madison Square Garden plus twin office towers on the site. In return for its property, the Pennsylvania would receive a quarter ownership of the complex. He planned similar operations in Philadelphia and Chicago. His overall plan was to diversify and become a conglomerate in order to be in concert with the age. Saunders came into the office in 1962 when he was ready to take the plunge with only one key element missing, the person who could perform the actual mechanics of takeovers, isolate likely properties, and above all, provide him with a plausible rationale and strategy. He found all of these desired attributes in Bevan, who possessed the instincts and the proper connections to make investments. Fortunate to Saunders, Bevan was prepared to cooperate in the diversification scheme.

In 1963 the Pennsylvania purchased a one-third interest in the Buckeye Pipe Line, the eighth largest processor of crude oil in the nation and one of the most important suppliers of jet fuel to the airlines, for $28 million in cash and preferred stock, and the rest of the shares were acquired in the next two years. As a sound company in a growing industry, Buckeye could be counted on to provide the money Saunders would need for future takeovers. In the following year Saunders purchased a 60% interest in the Great Southwest Corp., a land developer that owned several properties, including an amusement park, Six Flags Over Texas. Great Southwest was planning more of them at a time when Disneyland was doing well. In 1965 Saunders purchased an additional 20%, believing that real estate and related activities were the future for the Pennsylvania. Then, he purchased a controlling interest in Arvida, which owned approximately 100,000 acres of land in Florida, and next Macco Realty, a California-based company. After that he acquired Strick Holding Co., a manufacturer of aluminum trailers and containers with an interest in mobile homes, and made loans to Executive Jet Aviation. At the same time, Saunders sold the Long Island Railroad to New York State for $65 million, freeing the Pennsylvania from a commuter line that, like all such operations, was incapable of producing any profit. As a side note, it was later discovered that some of these properties were acquired by the Pennsylvania through Penphil, an investment company Bevan organized in 1962, so Bevan was on both sides of the deal.

After crossing some hurdles, the Interstate Commerce Commission (ICC), which was chartered by the Senate in 1887, recommended approval for the proposed merger in late 1965; and the Supreme Court approved the merger on January 15, 1968. Now, all parties agreed the date for the inaugural of the new company to be February 1, 1968, with Saunders being chairman and CEO and Perlman president and COO. Then in late March, 1968, the first annual report, prepared by the Pennsylvania staff without any input from the Central's staff, was released on the traditional day for the Pennsylvania. It was subtitled: "121st Annual Report," indicating implicitly that the new company was building on the Pennsylvania's tradition. Also, the New York Central Building was purposely named as the New York General Building. Beyond all these, Perlman and his staff remained in New York, and Saunders stayed in Philadelphia.

The new company, the Penn Central, was structured with three levels of ownership and operation. At the apex was the Penn Central Transportation Co., which owned and operated the railroad properties and was charged with the development of railroad-controlled real estate. It also owned all the stock of the Pennsylvania Company, which in turn owned the shares of the newly acquired non-railroad properties. Most of the Central's executives worked for the Transportation Co., and had nothing to do with the Pennsylvania Co., constituting another sign that Penn Central was really the Pennsylvania's takeover of the Central. In terms of management, the Penn Central was mess. Specifically, its chairman was more interested in non-railroad-related activities than in the company's main business, its president was totally ignored, and its chairman of the finance committee operated and owned outside interests that conflicted with his main job.

The sustained recession continued to hurt the business of railroads. The operation revenues of the Penn Central had fallen from $1.7 billion to $1.6 billion, while returns on investment had gone from 2.7 to 0.8%. In 1968 the company's operating losses came to the formidable $140 million. More troublesome was that the dividends from the newly acquired companies were less than what had been received from those sold. Then there was the matter of the New York, New Haven & Hartford, which cost $128 million and whose deficit in 1968 alone was $22.3 million, and still rising. To obtain union support for the merger and assure labor peace, the Penn Central had to guarantee employment to all existing workers.

On the other hand, from the corporate suites to the field, dissension and animosity were wide spread. For instance, since the first day when David Smucker of the Pennsylvania became Perlman's deputy in New York, these two men clashed to the point that they were not on speaking terms. In the field, the Pennsylvania crews were used to hauling coal so one carload could be substituted for another, while the Central people were accustomed to handling manufactured goods that required accurate and prompt delivery. So, the Central crews accused the Pennsylvanians of being slovenly, and the Pennsylvanians resented what they took as the arrogance of the Central people. As a result of all these dissension and animosity, there were foul-ups, misrountings, bottlenecks, and utter confusion, which were followed by floods of complaints from major industrial customers, such as Allied Chemical, Stauffer Chemical, and the New York Perishable Dealers' Association. Eastman Kodak's piggyback vans missed connections in St. Louis three quarters of the time. All the unhappy customers were firmly convinced that the new company was the combination of the worst aspects of each parent. So they switched to the service of trucks.

Strapped for funds, the Penn Central sold Six Flags Over Georgia in 1968, and Six Flags Over Texas the following year. Then a managerial shakeup took place with Perlman forced to accept the insignificant post of vice chairman and replaced as COO by Paul Gorman, the recently retired president of Western Electric who had a fine record, especially in the area of cost controls, but knew nothing about railroads. Surprised by what he discovered, Gorman started cutting costs left and right without exactly knowing what he was doing. So, for 1969, the Penn Central's

railroad operations were just about break-even. However, an extraordinary loss in the investment in long-haul passenger service facilities came to $126 million. This looked like a charge for merger costs, something stockholders and analysts had come to expect. At the same time, by demanding subsidiaries remit special dividends to the parent, Bevan enabled the Penn Central to report decent earnings while stripping the subsidiaries' treasuries. In particular, Merchant's Dispatch Transportation, a trucking company, reported a 1969 profit of $2.8 million and remitted $4.7 million. New York Central Transport, another trucking subsidiary, had profit of only $4.2 million and yet paid $14.5 million in dividends. So did it go with the others as well.

Realizing what was forthcoming with the railroad operations, Saunders formed the Penn Central Co., an organizational structure in which the Transportation Co. and the Pennsylvania Co. would be distanced from each other. In case the Transportation Co. fell into bankruptcy, the Pennsylvania Co. could potentially survive. As expected, the situation at the Transportation Co did not improve. In March of 1970, knowing that $100 million in debt was due to mature, Bevan suggested the company to issue that amount in new bonds. However, the offering failed to attract buyers and was withdrawn. Saunders and Bevan then approached the company's lead bank for a loan, but they were turned down. Similar response was met with approaches to Secretary of Transportation John Volpe. In late April affected by newspapers stories, Penn Central's common stock dropped on heavy volume; and banks were dumping the stock, too.

Gorman informed the board of the parlous situation on June 8 and advised the members that Secretary Volpe had relented and would support legislation providing $750 million to help financially troubled railroads with some $300 million earmarked for the Penn Central. Additionally, the government would guarantee $200 million of Penn Central notes for six months or until the legislation passed. In return, the government would decide how the money would be allocated, and there would have to be a switch in management. In the end, Saunders, Bevan, and Perlman were dismissed. However, worse than what was announced to the board, due to congressional opposition the Nixon Administration withdrew its support with the announcement made after the stock market closed on Friday, June 19. Without any choice, on Sunday, June 21, the Penn Central Transportation Company filed for bankruptcy protection under Section 77 of the 1933 Bankruptcy Act. And, in effect, it became a ward of the court.

9.5 Some Remarks

What is obtained in this chapter is mainly developed on the dynamic qualitative and figurative analyses of the yoyo model along with their spin fields. After we deliberately establish the systemic results, we introduce a conventional calculus-based model to verify some important conclusions obtained earlier. Then, five case studies of several phenomenal success and failures of the recent past are detailed

for supporting some of the key points derived earlier using the systemic yoyo methodology. The presentation in this chapter vividly shows that the systemic yoyo model can be and have been meaningfully employed in the study of economic phenomena, leading to practically useful conclusions.

Chapter 10
Dynamics Between Small and Large Projects

In this chapter, we will investigate using analytic methods the roles of small and large projects in the development and evolution of a commercial company and why companies with a history of taking on large projects tend to eventually fail with large projects. From the point of view of the systemic yoyo model, this end seems to be quite clear. In particular, when a spinning yoyo focuses on taking in only smaller and weaker rotational fields, this specific yoyo will have a better chance to be long lasting and to grow with each acquisition of a smaller and weaker field than when it also takes in powerful rotational fields. On the other hand, when a spinning yoyo engages in conflicts only with same size or larger and stronger rotational fields, sooner or latter, this specific yoyo will have to face off with a much more powerful rotational field than it is. So, as soon as it faces with such a powerful field that is so powerful that it just simply destroys the specific spinning yoyo. For this end, please consult with Case Study 10.1 in Sect. 10.6 below.

In terms of small and large projects, analytic models are established in this chapter to (1) describe investors' behaviors; (2) depict the dynamics between CEOs and their boards of directors; and (3) reveal how profit ceilings exist for large projects.

After making the concepts of small and large projects precise, we establish several analytic models for the investigation of the behaviors of various market participants. Then, we develop an explanation for why some decision-makers like to take on large projects and why most new start-ups fail because of a lack of funds. A theory is given to show how investors value small projects more than large projects and why the current trend of moving manufacturing operations from industrialized nations to third world countries does not seem reversible in the foreseeable future, as long as international transportation costs stay low and the global economic system stays open and competitive. Among other results, it is also shown that

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(1) the higher the level the CEO's initial ability is, the more likely he would initiate and manage small projects, and the more labor effort, he will devote to these projects;
(2) the CEO's additional effort spent on the small projects helps him gain non-pecuniary benefits, which he can use to gain additional bargaining power over the board;
(3) to realistically maximize his private utility, the CEO would spend more of his time and effort on small projects;
(4) each large project has a glass ceiling for its maximum level of profits;
(5) companies taking on large projects cannot afford to devote much of their scarce resources to expand their market share and appearance; and to increase their profit potential, these companies have to control their spending so that their profit can be maximized by lowering their unit selling price p_s;
(6) for small projects, the profit potential for the company is unlimited.

All the theoretical conclusions presented in this chapter are used to analyze three specific case studies from the current emerging Chinese economy. It is expected that along with the real-life case studies, these conclusions could provide some useful guidance for practical management decision-makings in terms of small and large projects. This work is the first to employ models of human behaviors to research the interactions and dynamics between projects of different scales. It provides a theoretically reliable distinction between small and large projects.

To empirically support the conclusion that when a spinning yoyo constantly engages in conflicts with other rotational fields of whatever intensity and strength, sooner or later, this yoyo will have to face a mighty field that it cannot handle. Consequently, it will be destroyed, at the conclusion of this chapter, we look at a relatively detailed account of the investment banking firm of Drexel Burnham Lambert in Case Study 10.1. In particular, although it is recognized in economics that capitalism requires competition to function efficiently, unbridled capitalism could lead to a jungle environment in which none are safe and simple survival, not progress, is a matter of concern. As the jungle environment spread, the fabric of society would start unraveling. When deviance is common, it ceases to be deviance and becomes the rule, and from there the path to anarchy is open. Historically, in only a few years during the conglomerate era, there appeared such giants as ITT, Gulf + Western, and especially James Ling's LTV. When the new breed of the businessmen behind these giants threatened the existence of many large and midsized companies, the government was pressured to find the legislative means to block their activities. In the case of LTV, it ended with that company's bankruptcy and James Ling's removal from the business scene. A similar situation happened at the start of the twentieth century that resulted in the antitrust movement and the prosecutions of big businesses during the administrations of Theodore Roosevelt, William Howard Taft, and Woodrow Wilson. Their chief target then was the "money trust," which reformers believed made the others possible. Behind the predatory businessmen were the bankers, led by J. P. Morgan, Kuhn Loeb, and

others. And, the history repeated itself again in the 1980s, when a new breed of takeover artist threatened the existence of many large companies, both old-line firms and newer conglomerates. As in the previous cases, targeted companies demanded legislation and instituted legal actions. The focus this time was on the investment banking firm of Drexel Burnham Lambert and its chief asset, Michael Milken, who were charged by the federal government with criminal violations. At the same time, Drexel had problems with other investment banks, which by its actions it had alienated, so couldnot turn to them for assistance.

The main results of this chapter are based on (Lin and Liu, to appear).

10.1 Introduction

To investigate the relationship and dynamics between large and small projects in a theoretically and practically meaningful way, let us first look at three case studies from the emerging Chinese economic market. Similar scenarios could be seen easily in all different economies from across the world. The reason why we choose examples from the Chinese economy is because in its current specific moment of development with largely under developed banking industry, the phenomena of small and large projects in China seem to be more prevalent and more fascinating.

Case 1: On April 8, 2009, Zhijian Rong resigned his position as the chair of the board of directors of CITIC Pacific (stock code: HK00267), where CITIC stands for China International Trust and Investment Company; and his partner Hongling Fan, the director CEO, also resigned from the company. They were respectively 67 and 61 years of age. Their resignations signaled the end of a legendary Rong era of the CITIC Pacific. In the past 100 plus years, the Rong's family has been extremely successful in the business world although the larger environment has gone through many historical changes: the late Qing dynasty, the warring chaos of the Republic of China, the anti-Japanese war, the war of liberation, the Cultural Revolution, and reform and reopening of China to the world. Each generation of the Rong's family achieved its success by strictly following the treasured family lessons: "Conduct business conservatively, take actions carefully, and absolutely do not participate in speculations." With the status of being a "red capitalist," Zhijian Rong enjoyed a luxurious playground that most others in the greater China area did not have. However, to prove the world that his success is solely the consequences of his own effort and intelligence, Zhijian Rong did not think twice before he violated his family lessons and gambled on Australian dollars. That single imprudent move turned out to be risky and cost Zhijian Rong almost everything he had fought for and accumulated in the past 30 plus years. For more details of this case study, please consult with (Zhen 2009).

Case 2: On January 12, 1997, several tens of creditors and news reporters jampacked the headquarter of the Giant Group, located in Zhuhai, Guangdong Province, one of the five special economic zones in PR China. With the intense news coverage, the public image of the Giant instantly collapsed. Even so, the crisis Giant Group

experienced could still be resolved. For example, although the expensive, national promotion effort on its health-related products had not produced the desirable outcome, the effort had indeed helped to build the company's credibility and leadership position in the marketplace. As for the financially draining Giant's Edifice, the underground parts had been completed. It required only about ¥10 million to get the construction moving so that the worries of the creditors could be eased and many suddenly appeared difficulties could be avoided, because according to the construction speed of the time, one floor of the edifice could be completed within each 5 days. However, due to the unexpected news exposure and his unpreparedness for the worst, Yuzhu Shi, the owner of the Giant Group, did not know what to do. Three months after the public exposure of the financial crisis, Yuzhu Shi introduced a reorganization plan for the Giant Group. However, after meeting with many different financial institutions, no agreement could be reached. As a result, the great Giant Group collapsed. See (Hu 2000) for more details.

Case 3: During the time period of about 4 years since the mid 1989, there had been a well-accepted saying in mainland China: "Where will you go for your next trip in central China? Yaxiya, Zhengzhou!" On May 6, 1989, the first Yaxiya Department Store, which occupied over 12,000 square meters of retail space, officially opened its door to the public in Zhengzhou, Henan. Since that day on for the next 9 years, this department store provided all shoppers an eye opening appearance with its innovative fashion of selling quality products. As one entered that Yaxiya store, he would have easily and mistakenly imagined that it was in a bright, luxurious five-star hotel. At the entrance, there was a water fall. Beautiful flowers and green grass could be seen everywhere throughout the store. All shelves were stuffed in an extremely organized fashion and all the aisles were wide and gave people an undeniable feeling of openness and freshness. What was unexpected to all the shoppers were the beautiful greeters, public relation specialists, and professional dancers serving the shoppers in the store. In the center, a live piano performance was given on the stage once every half an hour. What was most creative was the magnificent exercise in the morning of raising the national flag in the front of the store. For the period of several years, this morning exercise once became a site for all the tourists of Zhengzhou City. On March 5, 1997, Suizhou Wang, the founding CEO of the Yaxiya Group, officially resigned. After Wang's resignation, although three other CEOs were hired to revive the department store chain, the drastically failing situation could no longer be reversed. And this large ship of the retail business of Zhengzhou City eventually sank and faded into the memory. For a more detailed account of this case, see (Tao 1998).

There are surely many reasons underlying the ultimate failures of these and other similar companies in China and in other economies from around the world. However, what seems to be common to these cases is the interaction between our so-called small and large projects. A project is small, if it does not cost the company extraordinarily amount of financial assets so that if it fails, the financial well-being of the company is not fatally affected. On the other hand, if when a project fails or experiences crisis, the outcome will be disastrous to the financial well-being of the company, then the project will be referred to as a large project.

Assume that the company and its controlling interests, such as large, long-term shareholders, the CEO, and others want long-term growths for the company. Then, the question we will study in this chapter is the following: Should the board of directors and the management focus on small projects or large projects? Or should they stay away from one kind of project, either small or large, altogether? To make our presentation easier to follow, let us assume that all the companies considered in the following are publicly traded, although in reality they do not have to be as long as they involve investors who want to make a profit by financing or participating in activities of the companies.

Due to how we define small and large projects, it is ready to see that when a small project fails or experiences a crisis, the large, long-term shareholders might suffer from some minor and temporary losses. On the other hand, if a large project fails, all the shareholders would lose most of their stakes, if not all, invested in the company, and all the senior administrators, especially the CEO, of the company would lose their jobs, due to their failing performance. The CEO would be replaced by the board or the company would go through a hostile takeover. In either case, the CEO loses his job and his privilege of control. For relevant studies, please consult with (Kaplan and Minton 1994; Shivdasani 1993; Denis and Serrano 1996).

More specifically, in Sect. 10.2, we will investigate the market behaviors of the projects of different scales. Through analytical reasoning we provide an explanation for why decision-makers favor large projects over small ones. It is shown that if one is successful with large project just once, twice, or a few times, he would strike it huge in the business world. On the other hand, if one is risk averse and takes on small projects only, it may very well take him forever to build his business to a certain respectable magnitude. Because the definition of small and large projects is asset-dependent, a specific project could be considered small for one company and immensely large for another company. The analysis in this section provides an explanation for why most new start-ups fail because of a lack of funds.

In Sect. 10.3, we look at the market response to large projects. What is shown is that for the option of taking on one large risky project, the marketplace tends to underestimate the benefit the potential success the large project would create for the company. That is, investors value relatively safe small projects more than large projects. In terms of the dynamics between small and large projects, in Sect. 10.4 we show that the higher the level a CEO's initial ability is, the more small projects he would initiate and manage, and the more labor effort, correspondingly, he will devote to these projects. The CEO's additional effort spent on the small projects helps him gain those non-pecuniary benefits, which he can use to gain more bargaining power over the board. At the same time, the CEO's increased number of successful small projects raises his level of ability so that he becomes more effective in his managerial duties, and consequently, the company's value increases instead of decreases due to the CEO's increased commitment to small projects. Also, to realistically maximize his private utility, the CEO would spend more of his time and effort on small projects.

Section 10.5 is devoted to the research of the invisible glass ceiling of profit for large projects. Among other results, it is shown that (1) each large project will have a glass ceiling for its maximum level of profits; (2) companies taking on large projects cannot afford to devote much of their scarce resources to expand their market share and appearance; (3) companies engaging in large projects just cannot take on such opportunities as placing large orders at much reduced wholesale prices. Similarly, other volume-related savings are not available to companies that engage in large projects. Contrary to the situation of imperfect capital markets (when large projects are concerned with, capital markets become imperfect), if the capital markets are perfect, then the profit potential for any project would be unlimited.

Using what are obtained in the previous sections, in Sect. 10.6 we look at the previous three case studies in more depth and conclude our chapter with some intriguing open problems.

10.2 Market Behaviors of Different-Scale Projects

To address our question, let us look at both of these two different categories of projects. Throughout this work, we assume that there is no discount of the future over time. Assume that in time period 1, the company commits I_s of investment to a small project; and in time period 2, the fundamental value of the project is v_s for the company when the project is fully completed and the benefit of the completed project is materialized in the marketplace. So, the expected profit from embarking on this small project is given as follows:

$$(v_s - I_s R_s)P_s, \tag{10.1}$$

where $R_s > 1$ stands for the gross interest spent on the total investment amount I_s, and $P_s \approx 1$the probability for the small project to be successful.

Similarly, assume that in period 1, the company invests as much as $I_L >> I_s$ for a large project. In time period 2, the project is completed and its benefit is fully materialized so that the fundamental value the project creates for the company is v_L. So, in this period, the expected profit from engaging in this project is

$$(v_L - I_L R_L)P_L, \tag{10.2}$$

where $R_L > R_s > 1$ is the gross interest spent on the total investment I_L and $P_L \approx 0$ the probability for the large project to be successful for the reason that large projects tend to involve many unexpected factors that may turn out to be detrimental to the success of the projects. The reason why $R_L > R_s$ is that the large project tend to be much riskier than the small project so that the lender of funds charges a much higher rate of interest.

Now, the large project is lots riskier with much greater return if successful than the small project. So, if the company decides on investing in the large project, the

return has to be proportionally much higher than that of the small project. So, we have the following equation:

$$k(v_s - I_s R_s)P_s = (v_L - I_L R_L)P_L. \tag{10.3}$$

where k is the constant of proportionality. By rewriting this equation, we obtain:

$$kv_s P_s = v_L P_L + kI_s R_s P_s - I_L R_L P_L. \tag{10.4}$$

If $P_s = \ell P_L$, for some large real number $\ell > 1$, Eq. 10.4 can be rewritten as follows:

$$k\ell v_s = v_L + k\ell I_s R_s - I_L R_L \text{ or } k\ell(v_s - I_s R_s) = v_L - I_L R_L. \tag{10.5}$$

Equation 10.5 provides an analytic explanation for why some decision-makers like to take on large projects because the success of just one such project would produce as much financial profit as $k\ell$ many small projects completed one by one. Considering the meanings of the constants k andℓ, the product $k\ell$ can potentially be a really large number. In particular, it means that if one is successful with large project just once, twice, or a few times, he would strike it huge in the business world. On the other hand, if one is risk averse and takes on small projects only, it may very well take him forever to build his business to a certain respectable magnitude.

The definition of small and large projects is asset-dependent. That is, when companies have different market capitalizations, their definitions of small and large projects change from one company to another. A specific project could be considered small for one company and immensely large for another company. So, Eq. 10.5 provides an explanation for why most new start-ups fail because of a lack of funds, since due to their limited financial resources, almost all projects new start-ups take on would be considered large. In this case, if they do not make it with just one project, the companies would be over permanently.

10.3 Market Response to Large Projects

Assume that a company has a choice of either taking on relatively safe small projects or one large relatively risky project in time period 1. If the company chooses the option of small projects, then its stock is traded at p_s ($< . = ,$ or $> v_s$) in time period 1, where v_s is the fundamental share-value of the company. In this time period, an investor buys $n(p_s)$ shares of the stock at the market value p_s a share. His total cost of investment is $I_s = n(p_s)p_s$. Assume that in time period 2, the trading price equals the fundamental value v_s. So, the profit of this investor is given as follows:

$$n(p_s)v_s - I_s R_s = \frac{I_s v_s}{p_s} - I_s R_s = I_s\left(\frac{v_s}{p_s} - R_s\right), \tag{10.6}$$

where as before $R_s > 1$ is the gross interest spent on the total investment I_s.

On the other hand, if the company takes on the choice of one large, risky project, the same investor buys in period 1 $n(p_L)$ shares of the company stock at p_L a share, where $p_L <$, $=$, or $> v_L$ with v_L being the fundamental share-value of the company stock. So, the total cost of investment to the investor is $I_L = n(p_L)p_L$. In time period 2, assume that the project is completed with its consequence known so that the fundamental share-value v_L is materialized. So, the total profit for the investor is given as follows:

$$n(p_L)v_L - I_L R_L = \frac{I_L v_L}{p_L} - I_L R_L = I_L\left(\frac{v_L}{p_L} - R_L\right), \tag{10.7}$$

where $R_L > R_s > 1$ is the gross interest spent on the total investment I_L.

If the investor wants to produce more return on his investment of the large project option, then from Eqs. 10.6 and 10.7, we have

$$I_s\left(\frac{v_s}{p_s} - R_s\right) < I_L\left(\frac{v_L}{p_L} - R_L\right). \tag{10.8}$$

From the assumption that $I_s = I_L$, meaning that the investor allocated the same amount of funds to each option of investment, we have

$$\frac{v_s}{p_s} < \frac{v_L}{p_L} - (R_L - R_s) < \frac{v_L}{p_L}. \tag{10.9}$$

From the assumption that the choice of small projects contains a huge number of relatively safe small projects completed one by one so that the totality of the small projects does not become a large project, we can take $\frac{v_s}{p_s} \approx 1$. That is, the market read on the potential values of the relatively safe small projects in time period 1 is very close to that of the fundamental value materialized in period 2. So, we have from Eq. 10.9 that

$$\frac{v_L}{p_L} > 1. \tag{10.10}$$

This end implies that for the option of taking on one large risky project, the marketplace tends to underestimate the benefit the potential success the large project would create for the company. That is, investors value a large number of relatively safe small projects completed one by one more than one single large project.

10.4 Dynamics of Small and Large Projects

To study the dynamic interactions between small and large projects a company might take on, we have assumed that the controlling shareholders and administrators of the company care about the near-term earnings for the stability of their

investment portfolio; and their main focus is about how to improve the long-term, healthy growth, even if they have to temporarily suffer some short-term financial setbacks.

Because of the somewhat contradicting desires of the shareholders and the administrators of the company, all parties involved both implicitly and explicitly allow the CEO to embark on both small and large projects for the company. As what has been argued earlier, from the small project option, investors could foresee their values and the near-term growth in the company. For the large project option, although investors in general underestimate their potential benefits, if such a project is well researched, orchestrated, and carried out to its successful conclusion, the eventual success often creates enormous financial return and publicity, both of which are needed for the company's future growth, and enhances the company's image in terms of public relations both internal and external to the company, and many other tangible and intangible benefits.

10.4.1 The Model

In this subsection, we establish a simple model for the effect of the CEO taking on the small project option on the value of the company in the eyes of the numeraire investor, which stands for the totality of all the stakeholders of the company. Suppose once again that there are two time periods, $t = 1, 2$. In period 1, the CEO puts in his labor and time to work on various projects, both small and large. As in (Conyon and Read 2006; Lin 2008b), in this period, the value of the company is

$$y = a + e + \varepsilon, \tag{10.11}$$

where a stands for the CEO's level of ability, e his labor effort, and ε a normally distributed random error with mean zero. That is, investors in the marketplace value the company in terms of the CEO's ability, effort, and a random noise that is not influenced by the variables a and e.

Because the CEO does not want to lose his job, he has to work on his company's short-term equity performance by taking on some small projects, even though he is aware of the fact that if he is successful with at least one large project, he can drastically build up his career by increasing his company's assets and value. So, for both the company and the CEO, the real cost for the CEO to focus solely on the small project option is the opportunity costs of his time and effort, if the capital market is perfect, meaning that investment capital is not a problem; when needed, the company can always take out loans. The CEO's time and labor effort not spent on the large project option may well result in lost opportunities for the company's exponential growth. That is, the CEO's total labor effort e is split into two parts: e_s and e_L, where the subscript s stands for the amount the CEO spends on the small project option and the subscript L on the large project option. So, the value of the company as seen in the eyes of the stakeholders becomes

$$y = a + e_L + \varepsilon, \tag{10.12}$$

where $e_L = e - e_s$ and $(-e_s)$ represents the labor effort the CEO spends on the small project option. In terms of the potential fast growth of the company and the CEO, $(-e_s)$ also stands for the opportunity costs for the CEO's working on small projects. The reason why the term e_s is not in Eq. 10.12 is because the market read of small projects are mostly the same as their fundamental values, we have combined it into the CEO's level of ability a, whereas the term e_L is not entire about his ability. As a matter of fact, beyond his intelligence and ability, this term also involves other factors, such as availability and accuracy of key information, and how different parties in the marketplace react to the same information.

One reason why the CEO would be happy to work on small projects is that such projects, as argued earlier, generally can realize their values in a short period of time. So, they provide an opportunity for the CEO to harness his ability through working with various factors in his working environment. So, in general, through taking on numerous small projects, the CEO becomes more effective in his work and decision making. Let the change in the CEO's ability in period 1 gained solely from taking on small projects be

$$h_1 = h(a_0, n) \text{ satisfying } h_1 > 0, \frac{\partial h_1}{\partial a_0} > 0, \text{ and } \frac{\partial h_1}{\partial n} > 0,$$

where n stands for the number of small projects the CEO initiates and manages in period 1 so that they do not become a large project (in the following, when small projects are concerned with, we always assume this is true), and a_0 his endowed initial level of ability, which all stakeholders of the company know from records and references. Because h_1 is an increasing function in n, we have assumed that taking on various small projects can enrich the CEO's knowledge base. Therefore, the ability of the CEO in period 1 is given by $a_0 + h_1$, and the company's value in period 1 is given as follows:

$$y = a_0 + h_1 + e_L + \varepsilon. \tag{10.13}$$

That is, in period 1, the CEO decides on how many small projects n to initiate and manage and how much labor effort $e_s = e - e_L$ to devote to these small projects so that he maximizes his personal utility function:

$$U = E(w) + \beta(E(y) + E_b(a_0, e_s, n)) + D(e_s, n), \tag{10.14}$$

where $E(w)$ is the CEO's expected wage from the company, which is determined by the board in period 2, and $E_b(a_0, e_s, n)$ (≥ 0) his expected nonpecuniary benefits gained from these small projects, such as recognition locally, reputation within the industry of the company, etc., satisfying $\frac{\partial E_b}{\partial x} > 0$, for $x = a_0$, e_s, or n, and $E(y)$ stands for the expected value of his company in period 1, as seen by the stakeholders, and $\beta \in (0, 1)$ is a parameter measuring the degree the CEO cares about how well his company does under his leadership. Here, $D(e_s, n)$ stands for the CEO's disutility of initiating and managing small projects.

In period 2, based on the observed value of the company from period 1,

$$y^* = y\left(n^*, e_s^*\right) = a_0 + h_1^* + e_L^*, \tag{10.15}$$

where the y^*-value is uniquely determined by n^* and e_s^*, the board decides on how much compensation w to pay the CEO. Here * stands for observed values. Based on the idea of Nash bargaining, the board and the CEO negotiate a specific amount w of compensation to pay the CEO by solving

$$V = (y^* - w) \times w^{\alpha} = \left\{\left(a_0 + h_1^* + e_L^*\right) - w\right\} \times w^{\alpha}, \tag{10.16}$$

where $\alpha \in (0, +\infty)$ represents the bargaining power of the CEO over the board. For instance, when $\alpha \approx 0$, the board has almost 100 percent bargaining power over the CEO. On the other hand, when $\alpha \to \infty$, the CEO has a dominating influence over the board.

10.4.2 Model Analysis

To solve our theoretical model, let us begin by considering the negotiation between the board and the CEO in period 2 on the specific value of w. The negotiation results in the maximization of V in Eq. 10.16 with respect to w subject to the constraint $w \leq a_0 + h_1^* + e_L^*$. Denote the solution to this problem by $\hat{w}$. Then, we have

$$\hat{w} = \frac{\alpha}{1+\alpha} y^*. \tag{10.17}$$

At the extremes, we have $\alpha \approx 0$ and/or $\alpha \to \infty$. When $\alpha \approx 0$, that is, when the board has nearly total control over the CEO, the board pays the CEO almost none of his contributions to the value of the company. According to Becker's rotten kid theorem and Theorem 10.2 (Lin 2008b, pp. 156, 162), at such an extreme, the CEO would not voluntarily try to maximize the value of the company. This, of course, is not what the board wants to happen. On the other hand, if the CEO has a dominating influence over the board, $\alpha \to \infty$, the board would pay the CEO nearly the entirety of his contributions to the value of the company. Because this circumstance does not fit well with the setup of our situation, where large, long-term stakeholders control the board and the company, this extreme is unlikely to occur. So, what is left open is interesting: Eq. 10.17 implies that the CEO, other than trying to create value, is motivated to gain as much control over the board as possible, and the board wants to stay as independent from the CEO as possible.

Now, in period 1, anticipating the compensation $\hat{w}$ in Eq. 10.17, the CEO chooses n- and e_s- values. The CEO's indirect utility is given by

$$U = U\left(n, e_s\right) = \left(\frac{\alpha}{1+\alpha} + \beta\right) E(y) + \beta E_b(a_0, e_s, n) + D(e_s, n). \tag{10.18}$$

Assume that n and e are variables independent of each other. Then, for the maximization of U in Eqs. 10.18, 10.13 implies that the first-order conditions with respect to n and e are given respectively by

$$\begin{cases} \dfrac{\partial U}{\partial n} = \left(\dfrac{\alpha}{1+\alpha} + \beta\right)\dfrac{\partial h(a_0, n)}{\partial n} + \beta\dfrac{\partial E_b(a_0, e_s, n)}{\partial n} + \dfrac{\partial D(e_s, n)}{\partial n} = 0 \\ \dfrac{\partial U}{\partial e} = \left(\dfrac{\alpha}{1+\alpha} + \beta\right)\dfrac{\partial e_L}{\partial e} + \beta\dfrac{\partial E_b(a_0, e_s, n)}{\partial e} + \dfrac{\partial D(e_s, n)}{\partial e} = 0. \end{cases} \tag{10.19}$$

Considering the general properties of utility functions and those of Taylor expansions of multi-variable functions, without loss of generality, let us take the following more specific functions:

$$h(a_0, n) = f(a_0)n, E_b(a_0, e_s, n) = b(a_0)e_s n, \text{ and } D(e_s, n) = -e_s n. \tag{10.20}$$

That is, for each variable a_0, e_s, and n, the functions $h(a_0, n)$, $E_b(a_0, e_s, n)$, and $D(e_s, n)$ are linearized without sacrificing the needed conditions for each of these functions. In this case, in period 1, the CEO chooses the total number n^* of small projects to initiate and to manage, and his overall level $e^* = e_L^* + e_s^*$ of labor effort to work on his job as the CEO of his company with e_L^* amount of effort spent on potential large projects and e_s^* on small projects, where

$$n^* = \frac{\frac{\partial e_L}{\partial e}\left(\frac{\alpha}{1+\alpha} + \beta\right)}{\left(1 - \frac{\partial e_L}{\partial e}\right)(1 - \beta b(a_0))} \tag{10.21}$$

and

$$e_s^* = \frac{\left(\frac{\alpha}{1+\alpha} + \beta\right)f(a_0)}{1 - \beta b(a_0)}. \tag{10.22}$$

From $e_s^* > 0$, it follows from Eq. 10.22 that (1—$\beta b(a_0)$) > 0. So, Eq. 10.21 implies that the higher the level the CEO's initial ability a_0 is, the more small projects he would initiate and manage, and according to Eq. 10.22, the more labor effort, correspondingly, he will devote to these projects. His additional effort spent on the small projects helps him gain those nonpecuniary benefits $E_b(a_0, e_s, n)$, which he can use to gain more bargaining power over the board. At the same time, the CEO's increased number of successful small projects raises his level of ability by as much as $h(a_0, n)$. So, he becomes more effective in his managerial duties, and consequently, the company's value increases instead of decreases due to the CEO's increased commitment to small projects.

Additionally, because (1 - $\beta b(a_0)$) > 0, Eq. 10.21 implies that only when the marginal increase in the total labor effort e from working on all projects is greater than the marginal increase in the labor effort e_L spent on the large projects does the CEO take on additional small projects. And, when the marginal increase in the labor effort e_L approaches Δe^-, the marginal increase in the total labor effort e, the optimal number n^* of small projects the CEO would need to take in order to

maximize his private utility would approach $+\infty$. That is, to realistically maximize his private utility, the CEO would spend more of his time and effort on small projects.

10.5 Invisible Glass Ceiling of Profit for Large Projects

Assume that a CEO takes on a large project, out of which his company produces a specific product or a line of service for $\$p_s$ each unit. After averaging the entire cost of the project, it is determined that for each unit of the product or service, the total expense is $\$p_p$ each unit. Let $n = n(p_s)$ be the total number of units sold at the price $\$p_s$ per unit. Then, for this particular company, its profit from this single line of product or service is given by

$$P = \text{ profit } = n(p_s)\big(p_s - p_p\big). \tag{10.23}$$

Because the project is assumed to be large, it means that the capital markets are imperfect. That is, the profit P in Eq. 10.23 is subject to the following constraint:

$$n(p_s)p_p = I, \tag{10.24}$$

where I is the total available funds for the company to invest in its line of product or service and $n(p_s)$ is seen as the size of the inventory. The first-order conditions for maximizing the profit P subject to the constraint in Eq. 10.24 are given by

$$\frac{\partial P}{\partial p_s} = n'(p_s)\big(p_s - p_p\big) + n(p_s) = \lambda n'(p_s)p_p Z \tag{10.25}$$

and

$$\frac{\partial P}{\partial p_p} = n'(p_s)\frac{dp_s}{dp_p}\big(p_s - p_p\big) + n(p_s)\left(\frac{dp_s}{dp_p} - 1\right) = \lambda\left[n'(p_s)\frac{dp_s}{dp_p}p_p + n(p_s)\right], \tag{10.26}$$

where λ is the Lagrange multiplier. Substituting Eq. 10.25 into Eq. 10.26 leads to

$$(1 + \lambda)n(p_s) = 0$$

Equation 10.22 implies that $n(p_s) \neq 0$, which means $l = -1$. So, Eq. 10.25 becomes

$$n'(p_s)p_s = -n(p_s)$$

Solving this equation for $n(p_s)$ gives us

$$n(p_s) = \frac{n(p_{s0})p_{s0}}{p_s}, \tag{10.27}$$

where $n(p_{s0})$ is the initial market demand when the product or service is sold for $\$p_{s0}$ per unit. So, the company's profit P is given by

$$P = profit = \frac{n(p_{s0})p_{s0}}{p_s}(p_s - p_p) \tag{10.28a}$$

$$= n(p_{s0})p_{s0}\left(1 - \frac{p_p}{p_s}\right). \tag{10.28b}$$

Equation 10.27 indicates that to expand the market demand, the company has to decrease its unit selling price. Because the capital markets are imperfect, this means that the company has a limited resource to invest in its product. That is, the company cannot afford to compete with another company which has unlimited resources. Here, the company of our concern can also increase its profit by reducing its selling price p_s, if the company can keep the unit profit $(p_s - p_p)$ constant. However, unlike any other company with powerful financial backing, this specific company has a cap, $n(p_{s0})p_{s0}$ (Eq. 10.28b), on how much it can expand its potential of total profit. This comparison implies the following two facts:

1. When financial resources are limited, any project will have a glass ceiling for its maximum level of profits.
2. Due to limited resources, for large projects companies do not have many opportunities to locate extremely low-priced manufacturers. One reason is that the companies do not have the ability to place large orders, and also, they do not have the financial strength to create their own low-priced manufacturing operations to strengthen their ability to compete.

By comparing Eqs. 10.28a and 10.28b, we can see the following facts:

1. Companies taking on large projects cannot afford to devote much of their scarce resources to expand their market share and appearance. One reason is that they do not have much money to allocate for the purpose of promotion. Another reason is that, as Eq. 10.28b indicates, an excessive amount of spending will keep their unit selling price p_s high. To increase their profit potential, companies taking on large projects have to control their spending so that their profit can be maximized by lowering their unit selling price p_s.
2. Companies engaging in large projects just cannot take on such opportunities as placing large orders at much reduced wholesale prices. Similarly, other volume-related savings are not available to companies that engage in large projects.

Different of what is discussed above, if the financial markets are perfect, that is, if the project the CEO takes on is well funded with more than sufficient financial backings, then the CEO can maximize Eq. 10.23 without constrained by Eq. 10.24. In this case, the company would determine such a selling price $\$p_s$ so

that his profit P in Eq. 10.23 will be maximized. The first-order condition for this maximization problem is given as follows:

$$\frac{\partial P}{\partial p_s} = n'(p_s)\left(p_s - p_p\right) + n(p_s) = 0. \tag{10.29}$$

For each fixed p_s- and p_p-value, we have

$$n'(p_s) = -\frac{n(p_s)}{p_s - p_p}$$

This is a separable differential equation; its solution is

$$n(p_s) = \frac{C}{p_s - p_p}, \tag{10.30}$$

where C is the integration constant. If at the price level p_{s0} the initial market demand for the product is $n(p_{s0})$ units, then Eq. 10.30 implies that $C = n(p_{s0})(p_{s0} - p_p)$. Substituting this C-value and Eq. 10.30 into Eq. 10.23 leads to

$$P = profit = n(p_{s0})(p_{s0} - p_p). \tag{10.31}$$

Equation 10.30 implies that if the company plans to make a profit on each unit of its product, meaning $p_s > p_p$, then the constant C will be positive and $n(p_s)$ increases indefinitely as the selling price $p_s \to (p_p) +$. For reasons like competition or clearing out the specific product line, the company could choose to get rid of the product by selling it at a price p_s below the cost p_p. In this case, the constant C will be less than 0. If the company is involved in a competition to occupy a greater market share for its product, then Eq. 10.30 also implies that the company has to keep the unit price p_s as close to the cost basis p_p as possible to maximize the marker demand $n(p_s)$.

To maximize his profit P, Eq. 10.31 indicates that if the difference $(p_{s0} - p_p)$ stays constant, the lower the p_{s0}-value, the greater the demand $n(p_{s0})$ and the greater the total profit P. So, to generate as much profit as possible, the company has to keep its per-unit cost p_p as low as possible. Because costs like shipping and handling, insurance, storage, salesperson's salaries, etc., are exogenous to the company and are quite robust, the company's efficient strategy to drastically reduce the cost basis p_p is to locate a manufacturer who can massively produce the needed product at a price below all other competitors.

Because raw materials and energies are international commodities mostly traded on global markets, and due to the advances of information technology, all competing manufacturers can quite easily catch up with technological innovations, to purchase products at below-the-market prices, the company would naturally go to places where the labor quality is adequate and the labor costs are as low as possible. When many companies look for such ideal labor markets, manufacturing businesses naturally start to relocate in different geographic locations with as close to ideal labor bases as possible. This end explains why the current trend of moving manufacturing operations from industrialized nations to third world

countries does not seem reversible in the foreseeable future, as long as international transportation costs stay low and the global economic system stays open and competitive.

What is implied in the previous analysis includes the fact that if by reducing the unit profit ($p_s - p_p$) the company can greatly increase its total profit by gaining additional market demand, the company will try all it can to accomplish that goal. More specifically, the company might:

1. Launch an aggressive commercial campaign where p_p is increased to expand the market demand.
2. Acquire a larger number of units of the product at a much lower price, where p_p is decreased so that p_s can be accordingly lowered to attract more customers.
3. Lower per-unit shipping and handling costs with increased volume of business.
4. Lower per-unit insurance costs with increased volume of business so that the savings can be passed on to the customers to create a healthier market demand.
5. Increase the salesperson's wages. With such a potential of drastically increasing take-home pays, the salesperson would work harder and smarter so that the market demand is consequently pushed to new extremes.

Comparing to the situation of imperfect capital markets, as discussed earlier, in this case, the profit potential for the company is unlimited.

10.6 Case Studies

With the necessary theoretical foundation in place, we now look at all the three case studies, as listed in the introduction section, in more details.

For the **case # 1**, when he was 31-years-old, Zhijian Rong left his parents in Beijing for Hong Kong. With the dividend income HK$6 million of his father's investments made before 1949 in Hong Kong, he started his business career in 1978 by joining the electronics company established by two of his cousins in 1963. Through a series of bold investments, as of 1984, the wealth of Mr. Rong grew to the vicinity of HK$400 million. In 1986, Zhijian Rong started his legendary business career as a "red capitalist" by joining CITIC Hong Kong as an associate chair of the board and the CEO,

As soon as in charge, Rong put on a dramatic show: Spent HK$2.3 billon to acquire 12.5% of the stocks of Cathay Pacific Airlines. Cathay Pacific was an established company of air transportation with many international routes; it had been wholly owned by British investments. In order to acquire the control of this company, Zhijian Rong spent 6 months investigating the relevant records and books. After the results of his research were reported to the headquarter in Beijing, the CITIC Group approved this acquisition within 5 days. And the State Department of the central Chinese government particularly approved a loan in the amount of HK$800 million to be used to cover the operating costs. With such a great

success on record, Zhijian Rong established himself in the Hong Kong business world as a red capitalist.

In 1990, CITIC Hong Kong spent HK$500 million and acquired 46.3% of the stocks of Hong Kong Dragon Airlines, Limited. Two months after becoming the biggest owner, CITIC Hong Kong successfully turned Dragon Airlines profitable. During the same year, CITIC Hong Kong made its greatest investment in its history by paying the price of HK$10 billon to acquire 20% of Hong Kong Telecom when HKT's market capitalization was the highest in Hong Kong stock market.

At the end of 1989, CITIC Hong Kong acquired 49% of the stocks of Tylfull Company Limited by spending over HK$300 million. After that, by injecting the assets of HK Dragon Airlines and others, CITIC Hong Kong expanded its control of Tylfull to about 85%. In 1991, CITIC Hong Kong renamed itself to CITIC Pacific, which ever since has become the operational platform of capital of CITIC Group in Hong Kong.

In 1992, Zhijian Rong started his second round of capital operations. Eyeing on the huge market potential in the car sales area of Dah Chong Hong, Limited, CITIC Pacific issued additional stocks to the public at prices way above its net assets in order to raise enough funds needed to purchase a controlling majority in Dah Chong Hong. By the end of 1996, through various means Zhijian Rong personally owned over 320 million shares of CITIC Pacific, becoming the second largest owner of the company. After entering the twentyfirst century, CITIC Pacific has been more actively pursuing opportunities in mainland China in areas of real estates, projects of national infrastructures, etc.

In short, the smooth development in Hong Kong for ZhijianRSong as a private person and CITIC Pacific as a business entity has been accomplished on the basis of a series of audacious purchases and mergers without suffering from any setback. Throughout his career, Zhijian Rong constantly took risky moves contrary to his treasured family lessons. The development history of CITIC Pacific is also filled with mergers and victorious stories of how the small conquered the large. However, Zhijian Rong eventually fell suddenly in his final gamble with Australian dollars.

In March 2006, by mobilizing US$415 million CITIC Pacific acquired the complete ownership of Sino-Iron and Balmoral Iron, which respectively had the potential mining rights of over 6 billion tons of magnetite ore in Western Australia. This acquisition threw CITIC Pacific in a great whirlpool of demanding huge amount of AU dollars. And in the past several years, the AU dollar (vs US dollar) was increasing drastically. In order to reduce the risk caused by fluctuating exchange rates, during the time period from the August 2007 to August 2008, CITIC Pacific signed various contracts with Citibank, HSBC (Hongkong and Shanghai Banking Corporation Limited), and other financial institutions so that it realistically controlled over AU$9 billion, which was four times more than what was invested in the mining business. According to the agreements, each contact had a ceiling for maximum profits without a stop for losses. Along with the sudden occurrence of the financial crisis, the AU dollars devalued quickly. According to

the announcement made on October 20, 2008, the estimated loss for CITIC Pacific was HK$15.5 billion. If CITIC Group, the majority shareholder of CITIC Pacific, did not provide a loan of US$1.5 billion, CITIC Pacific would have fallen into bankruptcy. Eventually in December 2008, CITIC Pacific terminated the bleeding speculations of the AU dollars with a loss of HK9.1 billion.

For the analysis of this case study, what is worth noticing is that Zhijian Rong's close connection with the central government of mainland China had played an important role underlying most, if not all, of the business ventures of CITIC Pacific. For instance, other than what has been mentioned above, when Zhijian Rong suffered from the Asian financial crisis in 1997, CITIC Group also threw in over HK$1 billion. Yiren Rong, Zhijian Rong's father, was the vice president of China during 1993–1998; and Zhen Wang, the father of the former chair of CITIC Group, was the vice president of China during 1988–1993. That is, Rong's connection with the powerful CITIC Group from mainland China had made all his projects relatively small until the last one when the former chair of the CITIC Group had retired.

For the **case #2**, as for why the Giant Group, as an actively ran company with a large market capitalization of over ¥1 billon and a good reputation, collapsed suddenly within a short period of time, let us look at its brief history of development. One day in July 1989, Yuzhu Shi arrived in Shenzhen, Guangdong Province, with a little over ¥;4,000, which he borrowed from different sources, and the M-6401 desktop publishing software system, which he spent 9 months to develop, in his pocket. Although Mr. Shi has a slender body of the typical southern Chinese scholar, he indeed possesses the innate ability to take extraordinary risks. During his initial days in Shenzhen, Shi took the first audacious business venture in his life: He approached the "Computer World," a Chinese magazine targeting the novices and experts alike of the computer industry, for placing an advertisement for his "M-6401: A Historical Breakthrough," for the price of ¥8,400. His only request was that he place the advertisement before he actually paid for it. Thirteen days later, his bank account received three payments in the total amount of ¥15,820. Two months later, he made over ¥100,000. That was Mr. Shi's first pot of gold in his business career. He then spent all this money in advertisements. Four months later, he became a young millionaire.

Starting in January 1990, Mr. Shi spent 150 days and nights in the front of computers in a flat of student housing at Shenzhen University except for once a week simple shopping trips to stock up some bagged noodles. This time, what he produced was the M-6402 word processing software. When he finally walked out of the messy unit of student housing and stood at a new height in his career, he discovered that all his furniture was gone together with his wife whom he did not see for months. Arriving in Zhuhai from Shenzhen, he registered his new company with a sound name: The Giant. He announced that his Giant will become the IBM of China. Soon after the Giant was born, Mr. Shi made another audacious decision: Any retailer of computer products from any corner of China could attend the Giant's trade show held in Zhuhai free of charge as long as he purchased ten Chinese character cards from the Giant. Through the success of this idea, by

spending several hundreds of thousands of Chinese Yuan, Mr. Shi established the then-largest national sales' network of the computer industry in China. For the very next year, the sales of the Chinese character cards of the Giant jumped to the first place in area of the computer product retails, producing a net profit of over ¥10 million. Starting in 1992, the Giant became the leader in Chinese computer industry.

It was also at the 1992 peak of business success that Mr. Yuzhu Shi decided to build the eventually devastating Giant Edifice. The initial blue print was to have 18 floors without any planned involvement of real estate business other than it was mainly for internal use. However, as influenced by various other factors, the initial plan was modified to have 38 floors, 54 floors, and finally 70 floors. This edifice was one of the few early mainland Chinese real estate properties sold in Hong Kong. Along with the name of the Giant and its powerful promotional campaign, the sales of the Giant Edifice in Hong Kong went extremely well, selling way above HK$10,000 per square meters. Together with the sales within mainland China, Mr. Shi collected over ¥120 million. This unexpected success made Shi realized that the fast growing market of mainland China had many great business opportunities for him to exploit. Very soon, he decided to enter the then-hot market of health-related products. So, starting in 1993, Mr. Yuzhu Shi's business venture had many fronts.

With its quasi-military style operations, starting in May 1995, the Giant began its intensive and concentrated commercial campaign, promoting over thirty different new products, covering three different areas: computer, health, and medicine. For a short period of time, the Giant's commercials and news conferences appeared like a torrential rain pouring onto the entire Chinese consumer market. Several thousands of young and enthusiastic sales representatives contacted with all major retail outlets from around China. The products of the Giant appeared in the shelves of over 500 thousand major retail stores across the nation. Within half a year, the number of companies subordinate to the Giant grew from 38 to 228.

Along with the excitement of great success, what was unexpected to Mr. Yuzhu Shi was that at the specific time, the health-related markets were soon became saturated, while the Giant Edifice was like a black hole that could only be kept alive by constantly feeding it with huge amounts of hard-earned cash. Out of no choice, Mr. Shi gradually pulled the liquid funds from the operations of health-related products to feed the never satisfying black hole. Since October 1996, the headquarter of the Giant Group, located in the Hong Kong Industrial Park of Zhuhai City started to be busier than before with various creditors. According to the agreements, some of these people came to ask for their purchased properties from the Giant. However, to their dismay, what they saw was only a worksite that just peeked out of the ground along with some evidence that the Giant was losing its ability to continue the construction of the edifice. Three months later, the Giant collapsed and faded into the history.

Now, let us analyze how the Giant fell so suddenly in terms of small and large projects, although it can be analyzed from many other different angles. For example, the fall could be seen as caused by both external reasons and internal failures, or as a consequence of that Mr. Yuzhu Shi himself did not subjectively

provide his company an appropriate identity and did not address the question of along which direction his company would evolve. In short, the fall of the Giant was mainly caused by strategic errors, which can be summarized into one sentence: Large projects were taken without healthy financial backing.

In particular, when the Giant chose to become a diversified enterprise, its sole purpose should be about managing the risks involved in each of the product lines. However, the fundamental requirements for doing so, having sufficient finance so that all the projects together would not become a large project and reaching the average levels of profit of the individual economic sectors, were not met. The key to this case study is how to attract investments and how to apply available funds. Here, the Giant did not establish any long-term, stable relationship with financial institutions as a consequence of its lack of business planning and relevant strategic allocation of the business resources. Although the Giant was financially successful, its millions of liquid funds could only be enough to handle one of the large projects it engaged in. When several such large projects demanded the support of huge amounts of finance, the Giant failed quickly.

For the **case #3**, same as the previous two case studies, along with other problems, the Yaxiya Department Store chain also made similar mistakes by engaging too extravagantly in large projects without adequate financial backing. In the autumn of 1988, Suizhou Wang, a retired 32-years-old air force officer, accepted an offer to serve as the founding CEO of a planned department store. On May 6, 1989, Zhengzhou Yaxiya store opened its business after spending 198 days on the preparation and several hundreds of thousands of Chinese Yuan on the newspaper promotions in the greater Zhengzhou area. That amount of expenditure was more than the combined total of the promotion expenses of all other department stores in Zhengzhou for 1 year and produced the slogan that "Yaxiya, where you go over the weekend." This slogan was later replaced by "Where will you go for your next trip in central China? Yaxiya, Zhengzhou!" when Zhuzhou Wang brought his promotion campaign to the national level on Central Chinese Television channels. Almost over night, consumers took Yaxiya to heart. On the first day of the grand opening, tens of thousands of shoppers flooded the store. The store security had to place control on the inflow of the crowd by letting people in waves. Throughout that day, over ten waves of shoppers were allowed to enter; and at 6 o'clock in the afternoon, the store had to close ahead of its announced closing time because over 90% of all the prepared goods were sold out. In 1990, the Yaxiya store brought in the gross revenue of over ¥186 million, which put itself the 35th among all major department stores nationwide as a powerful rising star. And, in the next 3 years, the annual revenue of the Yaxiya store continued to rise at a rate of over 30%, ranking steadily at the first place in Henan Province.

During its 9 years of existence, the Zhengzhou Yaxiya store and the later Yaxiya Group, never produced an annual net profit of over ¥10 million. In September 1993, 1 year after Suizhou Wang (and his Zhengzhou Yaxiya store) was recognized at national and provincial levels for his magnificent achievements, on the basis of the Zhengzhou store Mr. Wang established Zhengzhou Yaxiya Group, Ltd., with the ownership expanded from original two stakeholders to six. All the

new investors made their fortune in Hainan, located in Southeastern China, in finance and/or real estates, respectively. These people literally pushed Suizhou Wang onto the road of expanding the then current Yaxiya department store into a chain operation. During the next 4 years, the Yaxiya Group opened one by one 15 large and high scale department stores by over stretching its then current business of a market capitalization of merely ¥40 million into an accumulated investment of nearly ¥2 billion. Along with the grand stores in Beijing, Shanghai, Guangzhou opened their business, it seemed on surface that the territory of the Yaxiya Empire was increasing day by day. However, unfortunately, this road of expansion was heading to the ultimate dismay of the Yaxiya Group. What was extremely astonishing was the fact that each of the chain stores started losing money on its first day of business without a single exception.

At the board meeting held on June 14, 1996, it was reported that Beijing store only brought in about ¥700–800,000 a day, Shanghai store within the range of ¥300–400,000 a day. All the chain stores within Henan Province were suffering from losses of about ¥4 million a month; and the stores in Beijing, Shanghai, and Guangzhou together suffered from losses in the vicinity of ¥20 million a month. One year later, Shanghai store closed its door. Starting at the end of 1996, a financial torrential rain began to pour down on top of the Yaxiya Group. On March 5, 1997, Suizhou Wang called a meeting with some of the high-ranking officers of the Yaxiya Group and officially handed in his resignation. In the following year, three different CEOs were hired to revive the sinking Yaxiya Group. However, no one could have truly saved such an ailing empire.

Within a short period of time of several years, such an ordinary department store as Yaxiya from central China expanded quickly into an empire of a large and high scale national chain without any adequate financial and cultural accumulation. Based on what is analytically analyzed in this chapter, the consequent collapse is a natural consequence and unavoidable. In the business world, there have been too many similar cases that came and went within brief moments of time. Although many reasons could be found for why this happened, one of the underlying fundamental causes is undeniably the dynamics between small and large projects.

Case Study 10.1 In what follows we will use the example of the investment banking firm of Drexel Burnham Lambert to show that when a spinning yoyo engages in conflicts only with same size or larger and stronger rotational fields, sooner or later, this specific yoyo will have to face off with a much more powerful rotational field than it is. When that happens, this specific yoyo will simply be destroyed. This presentation is based on (Sobel 1999a, pp. 165–188). For relevant events and discussions, please consult with (Bailey 1992; Carosso 1970; Ehbar 1985; Kornbluth 1992).

For the investment banking firm of Drexel Burnham Lambert, its root can be traced to the arrival in Philadelphia in 1817 of Austrian émigré, Francis Martin Drexel. As a portrait painter, Drexel traveled to South America to search for commissions. And as he went from country to country, he gained some knowledge

about money changing. Drexel returned to Philadelphia in 1831, where he participated in a brewery. Four years later he formed F. M. Drexel & Co., which dealt in bank bills. One of his sons, Anthony, gathered the bills from the interior and then brought them to the issuing bank for redemption. In 1847, with all his sons, Anthony, Francis, and Joseph, joining the firm, the name of the company was changed to Drexel & Co. Although their company at the time was a small player in an increasingly large pond, it helped finance the Mexican War by selling government bonds to its long list of customers. By the time of the Civil War in America, Anthony became recognized as one of the leading bankers in the city. Working in tandem with Jay Cooke, Drexel became one of the more important banks in financing the Union efforts in the Civil War.

In 1867 Joseph, the youngest Drexel brothers, went to Europe and organized Drexel Harjes & Co. in Paris. This establishment placed the firm in the international sphere. In early 1871, through the father of John Pierpont Morgan in London, Anthony established a connection with the 34-year-old John. Their meeting in Drexel office led to the formation of Drexel Morgan & Co. After that, J. P. Morgan returned to Wall Street and soon became the nation's leading banker, while Drexel remained in Philadelphia as the senior member of the alliance. At the time, Drexel Morgan and Jay Cooke & Co., both centered in Philadelphia, were the nation's two most powerful investment banks. Because they were full members of the community, they were gladly accepted as the community leader. Anthony died in 1893; and 2 years later, Drexel Morgan became J. P. Morgan & Co., and the reconstituted Drexel & Co. went off on its own. Under Anthony Drexel's successors the company continued to do well.

In the 1930s when the New Deal forced the separation of investment and commercial banking, Drexel abandoned investment banking and became a commercial bank, while some of the partners reconstituted the investment bank later. In 1950 it was the seventeenth largest syndicator in the nation, underwriting $20 million in securities, while the leader, Halsey Stuart, did $723 million of business. In 1965 Drexel merged with Harriman Ripley with the rationale that the combined assets of the two companies might lead to better times. As it turned out, it didnot. By 1970 Drexel had only ten Fortune 500 clients, and it was badly in need of capital. Learning that Firestone Tire & Rubber was interested in a foray into banking, Drexel traded a 25% interest in itself for $6 million cash from Firestone Tire & Rubber. Now the firm adopted a new name: Drexel Firestone.

In 1969 one of his professors at the Wharton School of University of Pennsylvania found Michael Milken a summer job at Drexel Firestone. With his good performance and dedication, Milken was offered an opportunity to continue on as a part-time trainee when he returned to school. As soon as he completed all the requirements for the MBA except the thesis, which was completed afterward, Milken came to work for Drexel on a full-time basis. He settled at the New York headquarter of the firm as director for "low-grade bonds" at a salary of $25,000 a year. At that time main actions of finance were in equities, and bonds were perceived as unpromising and dull. Milken was not troubled by the situation at all, since he well recognized that it meant he joined in the play at the bottom of the

bond-market cycle. With his keen mind and an extraordinary capacity for work, Milken turned out to be a convincing salesman with his own insightful understanding about bonds.

For Milken, investors had an inaccurate concept of what constituted risk and how it had to be reflected in securities prices. In particular, a Wall Street axiom of the time was that "the greater the risk the greater must be the reward." This means that common stocks, which had a lower claim on the company than its bonds, should provide investors with a higher yield than did the bonds, and such indeed was the case for the time. For instance, in 1949 when government bonds yielded an average 2.3%, high-grade corporate bonds 2.7%, and preferred stock 4%, the Moody's composite index of common stocks returned 6.6%. From the bull market of the mid-1950s, owners of common stocks gradually learned to obtain their rewards from the increasing prices of their shares instead of from dividends only. This situation remained the same when Milken appeared in New York. So he reasoned that something, such as this insight, was needed for bonds as well. Also, he recognized that the rating agencies—Standard & Poor's and Moody's—were correctly concerned with balance sheets and related data, but they assigned such matters far too much importance. To him, the management talents, works in progress, research and development, and the like, are equally important; these factors should and had to count for something! For young or reconstructed firms that were long on intangibles but short on tangibles, this should be particularly true. The values of all these aspects rested more on the abilities of managers and researchers than on the production of factories. Due to the difficulty that such intangibles could not be quantified at all, the rating agencies had assigned low ratings to the bonds sold for these companies, such as young or reconstructed companies that paid no dividends at all and whose earnings were meager. That was why these bonds became known as "junk" and had to be sold on the basis of their high yields. With this unique understanding of the bond picture, Milken found his niche at Drexel Firestone.

In 1973 upon an infusion of cash from Burnham & Co., a small conservative brokerage that I. W. "Tubby" Burnham founded in the difficult year of 1935, Drexel Firestone became Drexel Burnham with Burnham serving as the firm's president. Soon he retired and was succeeded by Mark Kaplan. Shortly thereafter Drexel Burnham became Drexel Burnham Lambert due to its acquiring Lambert Brussels Witter, a Belgian company that specialized in research.

While an epidemic of mergers and dissolutions of banks and brokerages appeared during the petroleum crisis of 1973, Drexel was doing extremely well, because by then Milken's unit had started generating striking profits. Armed with impressive academic research, Milken took three major steps. The first step was selling his ideas—and the bonds upon which they were based—to customers. The second step was to underwrite the bonds of those young, previously unrated companies in need of financing. And, the third step was to finance the raiders who were going after underpriced companies. In particular, for the first step, Milken's selling points as that: Every investment carried some degree of risk; the "junk" bonds were not as hazardous as was commonly believed. For example, in the

mid-1970 s, the bonds of MCI, then seen as an improbable competitor for AT&T, were safer than the government bonds issued by Argentina, because one can seize MCI for failing to pay interest, while one canot seize Argentina. At the same time, while the stocks of companies that failed often went to zero, bonds did not, since in the reorganization the bond-holders often received shares in the now reconstructed company. And, additionally, Milken advised his buyers that bonds were not to be viewed as long-term investments, but rather to be purchased for capital gains. By offering the bonds he underwrote and monitored carefully, Milken successfully convinced his expanding circle of wealthy investors, eventually including mutual funds, pension funds, insurance companies, and thrift institutions that he knew the securities very well and would notify them if and when they should be sold.

Once he successfully acquired a large body of powerful investors, Milken took the second step by underwriting the bonds of those young, previously unrated companies in need of financing. Because these companies could not obtain funding using the traditional methods, they had to pay high interest rates for Drexel and Milken to protect their customers. From 1977 to 1984, when Milken concentrated on the young and restructured companies, Drexel underwrote 166 junk-bond issues, only five of which wound up in bankruptcy. One of the successful issues was underwritten for Chrysler when, after that company barely escaped bankruptcy, it couldn't obtain financing elsewhere. With Milken's outstanding performance, Drexel accounted for one-third of all junk financing in 1978, and it led the field every year but one from then until 1989, and in many of them with more than half the market. For Milken himself, as the newspapers of the time liked to remark, he made more in remuneration than the total profits of most firms on the Fortune 500 list. In terms of the contribution of underwriting the junk bonds to the society, it was calculated that from 1980 to 1986, firms employing junk bonds accounted for more than 80% of all job creating at public corporations. So, in the late 1980 s Milken was hailed on Wall Street as the greatest banker since J. P. Morgan.

For his actions taken in the third step in his career, Milken received most of the plaudits. His accomplishments in this step not only made himself a billionaire, but also destroyed both him and Drexel. In particular, the opportunities presented at the time derived from an anomaly in how the stock market valued the assets of corporations as a result of the great inflation of the 1970 s. Not since the 1930 s had the prices been so out of line with their net underlying assets. The Consumer Price Index more than doubled from 1970 to 1980, while the stock market gyrated and wound up in 1980 close to where it had been a decade earlier, with the price/earnings ratio for the Dow Jones Industrials slightly higher than 7. What this meant was that the breakup value of companies that at the beginning of the period had large amounts of fixed assets and had obtained more along the way, had risen sharply, while the stocks of these companies were comparatively very low. This was particularly true for the petroleum companies. For instance, in the summer of 1981, Getty, which had assets of $250 a share, was selling in the low seventies. Marathon had $210 in assets and was in the high sixties. Cities Service had $130 a share in reserves alone, and was in the mid-fifties. In 1983 the engineering firm of

John Herold estimated that the shares of giant petroleum firms were selling for about 40% of their net worths. These were the fundamentals behind the hostile-takeover movement of the 1980s, during which fully one-third of the Fortune 500 companies vanished into mergers, liquidations, acquisitions, or simply fell by the wayside.

Fred Joseph, Drexel's CEO who joined the bank in 1974 as the head of the corporate-finance department, understood the situation and wanted the company to capitalize upon the situation by financing some of the raiders who were going after those underpriced companies. The method was in fact quite simple. Specifically, take a company whose breakup value was estimated at, say, $100 a share, whose stock was selling for $40. The raider would offer the shareholders $60. Management would protest that it was worth far more than that, and the raider would shoot back that if this were truly so, then management was admitting it had been doing a poor job. At the end the raider would obtain control of the company by using borrowed funds to pay the shareholders. While doing this he would have engaged the services of an investment bank to arrange for permanent financing. Milken and his team would then design a junk bond that would appeal to Drexel's long list of customers. In the end the raider would control a large company with a very large debt. Assets would then be sold and the money thus obtained used to repurchase the bonds, with substantial amounts left over for the raider. In 1983 Drexel underwrote its first billion-dollar deal for MCI Communications. The following year Drexel handled a complex leveraged buyout of Metromedia by CEO John Kluge. Metromedia was one of those conglomerates cobbled together in which the components were not dependent upon each other, and so might easily be detached and sold. It owned television and radio stations, outdoor advertising, and other non-related businesses.

To see how the whole idea works, let us consider an individual case. Kluge had purchased depreciation rights to $100 million of New York City buses and subway cars, invested $300 million in the nascent mobile-telephone industry, and expended $400 million in a stock-repurchase program. He had borrowed heavily to accomplish all of this. As a result his debt-to-equity ratio in the spring of 1984 was 3:1. Now, Drexel's bankers put together a plan so that Kluge's 26% stake in the company would become 75.5% through the replacement of equity by additional debt, much of the money coming from Prudential Insurance, which would receive short-term rates plus a fee for initiation. Kluge accepted the plan, and Drexel's bankers proceeded with the first stage, which was an offer of $30 a share in cash and debentures with a face value of $22.5 but an actual value more on the order of $10, for each share of stock tendered. When this offer was protested, Drexel added a half-warrant to purchase another debenture plus a 19-cents-per-share dividend prior to the buyout, which brought the total to around $41 per share. The shareholders accepted the deal on June 20. The next step was for Milken to arrange permanent financing. This was the key and questionable part of the deal. Metromedia's prior-year cash flow would not cover interest on the debt, and its net worth of debt was negligible. But Milken and Joseph knew the company's intangibles were quite valuable and could be disposed of easily for high prices. The financing

came in the form of a $1.9 billion debt offering, quite complex and the largest for a non-financial corporation at the time. The entire underwriting was cohandled by Drexel Burnham and Bear Stearns on November 29. Almost all of the buyers were lined up by the Milken team and the offering was sold out in less than two hours. Critics of the deal predicted Metromedia would fall into bankruptcy within a year. But in May 1985, Kluge sold the company's TV stations for $2 billion plus $650 million in debt. Other sales followed. By early 1987 Metromedia had raised closed to $6 billion through asset sales. Kluge made more than $3 billion, becoming one of the nation's wealthiest men. In theory, takeovers are supposed to increase efficiency by ousting inept corporate managers. However, as it turned out, they serve little purpose but to make millions for professional raiders, their lawyers, and investment bankers. As the previous special case demonstrated, as long as the bank, such as Drexel, had the power, imagination, and boldness, what could be done in a perfectly friendly fashion for Metromedia could also be done in a hostile fashion. Such indeed was about to happen on a large scale.

Along with its takeover efforts, Drexel's reputation on Wall Street and with clients suffered. For instance, James Dahl, one Milken associate, approached Staley Continental's CEO Robert Hoffman to suggest a leveraged buyout, indicating that if he did not agree to the plan, Dahl would find someone else and do the buyout, hinting that Hoffman would then be out of a job. A similar situation developed with other clients. At Green Tree Acceptance, Dahl double-crossed the client to get better terms for Drexel customers, who had purchased a large block of Green Tree stock. Fearing a hostile takeover, Green Tree repurchased the shares at $12 above their market price, providing a windfall for Drexel and its customers. A second example was T. Boone Pickens's failed 1983 run on Gulf, which wound up being taken over by Chevron at $80 a share. Pickens's shares, purchased for an average in the low fifties, had made his company, Mesa Petroleum, a profit of $500 million. As for Drexel, which handled the deal for Pickens, it not only earned a large fee, but Milken, who raised $1.7 billion from his customers in a few days, was now seen as one of the most powerful financers.

What went beyond the control of the situation was that the oil companies were not the only ones raiders sought. With the help of investment banks, mostly Drexel, raiders went after the likes of Revlon, TWA, ITT, and a host of other bloated, underpriced, or simply troubled companies. So, the CEOs of targeted companies or of companies thought of as becoming targets reacted on three fronts: through lobbying, working with friendly congressmen to pass legislation curbing takeovers, and on the publicity front. The key player in this effort was the Business Roundtable, which had been created in 1972 with the help of Secretary of the Treasury John Connally and Federal Reserve Chairman Arthur Burns. The Roundtable was composed of the CEOs of 200 of the largest American companies, which together accounted for half of the nation's GDP. Such individuals considered hostile takeovers the equivalent of business warfare. The chairman at the time was Champion International's CEO Andrew Sigler, who had some experience in this area from having successfully fought off three takeover attempts. Prompted by the Roundtable, in 1984 several congressional committees investigated takeovers

and consider framing legislation to curb them. This was also the way critics of the conglomerates had tried to bring an end to their activities. So, it appeared the takeovers might be ended through congressional action. However, nothing happened on the legislative front.

Along with the ongoing takeover game, Fred Hartley, CEO of Unocal, emerged as the most vociferous and clever adversary for raiders. By joining hands with others from the Business Roundtable and the American Petroleum Institute, he put together the kind of alliance of political liberals and economic conservatives that had ended the activities of conglomerates a generation earlier. To this mix he included representatives of the old Wall Street such as Dillon Read, CEO and future secretary of the treasury, and Nicholas Brady, whose firm refused to engage in hostile takeovers. As part of its counterattack, the Business Roundtable placed advertisements decrying raiders who plundered companies, leaving behind wrecked communities and companies crippled by debts incurred by having to raise immense sums to finance stock buybacks. CEOs appeared on television programs criticizing the predators. Indeed, it was difficult for the public to sympathize with a raider with Milken who made hundreds of millions of dollars on a single deal, and easy to do so for a worker in a town who was fired due to financial stringencies caused by hostile takeovers.

The real breakthrough for the counterattack came on May 12, 1986, when Drexel banker Dennis Levine was arrested on charges of insider trading in 54 stocks. The SEC's chief enforcement, Gary Lynch, and US attorney Rudolph Giuliani offered Levine a plea bargain if he would cooperate with them in unearthing his accomplices. Accepting the offer, Levine fingered several individuals, including Ivan Boesky, who in turn for acceptance of his plea bargain also named additional names. As part of his plea bargain, Boesky told Giuliani about his dealings with Milken. Armed with the Racketeer Influenced and Corrupt Organizations Act (RICO), Giuliani went after Drexel. Under the terms of the act penalties were harsh, and the need for convincing evidence to obtain indictments was minimal. In September 1988, the SEC charged Drexel of 21 violations of the securities laws. In late November the government initiated the filing of RICO charges against Drexel and Milken. All this occurred before an indictment or trail. With RICO, Giuliani felt he had the power to destroy Drexel without a trial. In mid-December, Giuliani told Joseph he was bringing forth indictments on RICO charges unless Drexel agreed to a settlement on his terms, making it very clear that Milken and Drexel were Giuliani's prime targets. For all the while the Business Roundtable and the congressional critics watched on the side, well aware that Giuliani was doing what they had intended to do, and in a swifter and more effective fashion. On December 21, Drexel agreed not to contest six charges of malfeasance and pay $650 million in fines and damages. The firm also agreed to add three outside directors, including John Shad, who was formerly a banker and then head the SEC. Finally, Drexel agreed to place Milken on a leave of absence, and no one at the firm would be permitted to remain in contact with him. Part of his earnings, $200 million, was to be held in an escrow account, and the company

was to cooperate in the government's investigations. Of course, all of these took place without Milken being convicted of any wrongdoing.

Nicholas Brady, who became secretary of the treasury in September 1988, did what Congress had not been able to do: eliminate junk bonds as a tool to corporate takeovers. Together with other actions taken by the Federal Reserve, the Comptroller of the Currency, and the Treasury, the desires of those embattled CEOs to rid themselves of raiders had been finally realized. On the other hand, in June 1989, without Milken on staff Drexel's bankers were unable to roll over $40 million of commercial paper for a client, Integrated Resources. Declaring itself illiquid, on June 15 Drexel defaulted on $1 billion of debt, most of which was owned by Drexel customers. Additionally, Drexel was now stuck with a junk portfolio of more than $1 billion that could not be marketed. Joseph had to take $400 million out of its securities subsidiaries, which caused reserves there to fall below capital requirements. In early February 1990, he was informed that creditors of Drexel's Belgian parent company had refused to extend its credit line for commercial paper. Drexel had $1 billion in its broker-dealer subsidiary, which ordinarily would have been available to the parent, but now the SEC ruled that the company had to raise money on its own. Joseph and other top executives spent the weekend of February 10–11 trying to raise more than $300 million, and failed.

E. F. Hutton was in distress in 1987. And on that occasion, with Washington's approval, other banks pitched into help until a suitor could be found. In comparison, Drexel was a huge bank, much large than Hutton, and its failure could demoralize the district and perhaps cause a major financial panic. So, Joseph informed Fed chairman Alan Greenspan and the head of the New York Fed, E. Gerald Corrigan, of Drexel's plight. However, they offered no help; neither did SEC Chairman Richard Breeden. Secretary Brady took a phone call from Joseph and did nothing. Making the situation worse for Drexel, its rivals on the Wall Street got into the act. Salomon Brothers announced it would no longer transact business with Drexel, which then was followed by others. Everyone else who might have helped refused to do so. Why? A Drexel officer summarized it well, "There are constituencies out there that have reason to dislike what Drexel has been able to achieve. We have found ways to finance medium-sized, growing companies. That has taken business away from the banks. There are clearly companies that have been attacked in the takeover game that feel very bitter about us… We were touch on the way up. We never made friends. We stole business from other firms. We made the banks look silly. This was payback time. The Establishment finally got us."

In late evening of February 12, Fed and the Treasury informed Joseph that Drexel either had to file for bankruptcy or accept a government-led liquidation. The next morning, the board voted for bankruptcy. At Drexel's dismay, other banks joyfully hired Drexel bankers and support staff. Smith Barney purchased its brokerage business, Salomon made a bid and won its database, which enabled that bank to become the leader in the junk-bond business. So, Drexel became history.

On March 29, 1989, a month and half after Drexel's failure, Benito Romano, who replaced the resigned Giuliani on January 18, 1989, finally brought a 98-count

indictment against Milken. When the prosecution began, Edward Bennett Williams, Milken's lead attorney, indicated he would file a plea of not guilty. However William was dying of cancer, and Arthur Liman took his place. In the end, on Liman's advice, Milken agreed to plead guilty to six felony counts, which involved parking securities, the differential in charges to a mutual fund, and assisting a banker in generating tax losses to lower his payments to the government. That is, the banker was not guilty with any wrongdoing. Liman had thought that since the charges were so minor, Milken might get off without having to serve time in prison. He was wrong. Milken was sentenced to 10 years, plus 1,800 h of community service a year for 3 years, and was fined $200 million, which came on top of $400 million he already paid into a restitution fund. Later there would be an additional $500 million.

Even with the guilty plea and the sentence served, to all those who understood what had happened the destruction of Drexel Burnham Lambert was not validated. However, very few had sympathy for either Drexel or Milken. Why is that so? It is because when a spinning yoyo engages in constant conflicts with other fields, it generally victimizes many innocent spin fields. Consequently, all other yoyo structures, which do not wish to be victimized, will be forced to form alliances to fight back. To this end, there is an important moral to be learned: Don't anger your business rivals.

What are obtained in this chapter is both theoretically and practically interesting. For instance, for a business entity to grow from its original state of nonexistence, its founders have to take risks by engaging in large projects. However, as the business grow to a certain magnitude, the officers of the company have to consider more small projects than large projects in order to keep the business stay viable for the long haul. To this end, what is left open and unaddressed is that in the spectrum of business development, how can one determine when a specific company should start to scale back from taking too risky behaviors? Also, how does one determine the number of small projects that together constitute a large project?

From the point of view of the CEO, if he likes to keep his job and all the accompanying privilege of control, then he should focus more on small projects and bring as many of these projects to their successful conclusions as possible. It is because, according to what is shown in this chapter, market participants value small projects better than large projects. On the other hand, the definition of small and large projects is asset-dependent. So, another open and unsettled problem is the following: When the market capitalization of a company is given and all the financial resources of the company is known, how can one more specifically separate small and large projects so that it will make the lives of the day-to-day decision-makers easier?

Another interesting phenomenon is that when a company is closely associated with a financially powerful backing, such as in the case of CITIC Pacific, how can one define small and large projects? In this case, the powerful financial backing could be seen at least as providing perfect capital markets plus political willpower. In this case, no project is large. However, for the CEO, he still has to consider what

projects could be large for him personally because when he needs bailout from the powerful backing, he might well be replaced, just as in the situation of Zhijian Rong and Hongling Fan with CITIC Pacific. After these two men resigned (or replaced), the company has rebounded and been doing fine.

Part IV
Systemic Structure of the Human Mind

Chapter 11
Nature and Man

This chapter will show that human bodies are systems; the nature is also a system, consisting of many other systems, including humans. To this end, we make use of the traditional Chinese medicine, the classic, named Tao Te Ching, and the systemic yoyo model as the foundation of reasoning. The content of this chapter is mainly from (Lin and Forrest to appear a).

More specifically, in Sect. 11.1, we show by visiting some of the basic concepts and theory of the traditional Chinese medicine how human body has been studied and treated as an organic whole since the very start of the recorded history over 5,000 years ago. In Sect. 11.2, we glance over the most translated classic Tao De Ching to see how since antiquity man and nature have been investigated holistically as systems related and connected to each other.

11.1 The Human Body, as Seen in Chinese Traditional Medicine

For our purpose of showing how human body has been studied and treated as an organic whole since the very start of the recorded history over 5,000 years ago, let us look at the Chinese traditional medicine with some details.

The theory of Chinese traditional medicine is based on four primitive terms: Yin, Yang, Qi, and Xue. Here, Xue might be identified with blood in the Western medicine, which by the way no one knows the correctness of this identification for sure. Qi is some kind of vapor, which together with Xue is supposed to carry oxygen and various nutrients throughout the human body, and which guarantees and nurtures the balance of Yin and Yang. As for Yin and Yang, they also have various meanings. For example, running a fever is Yang, and feeling cold is Yin. Each organ of the human body or the entire body can be controlled by either Yin or Yang. In general, Chinese traditional medicine is not concerned with microorganisms or details of the

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body's organs and tissues. The strength of this classical medical discourse lay rather in its sophisticated analysis of how functions were related on many levels, from the vital processes of the body to the emotions to the natural and social environment of the patient, always with therapy in mind. Chinese medicine is best evaluated in the light of this strength rather than according to criteria that could not have been applied until half a century or so ago. For more comments along this line, see Sivin (1990). Some modern physicians who have not troubled themselves to study classical medical doctrines dismiss them as futilities of the feudal past. Others have portrayed classical medicine as a remarkable corpus of theory–based on adaptations of the Yin-Yang and five-phases concepts—that succeeded in understanding the body as a many-leveled system and treated its ills holistically. To be more specific, let us concentrate on a small branch of Chinese traditional medicine: acupuncture.

As a means of curing diseases, acupuncture is effected by needling certain related points on the human body to invigorate the meridian system and to harmonize Qi energy with blood circulation. According to the literature, unearthed cultural relics, and the related research on the laws of development of societies, the art of acupuncture had germinated way before the written language was created (Qiu and Zhang 1985). The study of the cultural relics unearthed in 1963 shows that the use of stone needles can be dated back to more than 14,000 years ago. Accompanying the invention and development of metallurgical technology, by the time the earliest medical book "Canon of Medicine" (300–500 B.C.) was written, ancient stone needles, bone needles, and bamboo needles, has been gradually replaced with bronze needles, iron needles, gold needles, and silver needles. And in our modern time, stainless steel needles have been in use.

As the history indicates, many had considered that China's Yellow Emperor of 2600 B.C. to be the founder of acupuncture, and the number of acupuncture points known to the physicians had been gradually increased through generations of practice. A total of 295 acupuncture points, including 25 single points and 135 double points were described in the earliest medical book "Canon of Medicine" (300–500 B.C.). In the "Jia Yi Classics of Acupuncture," written by Huanfu Mi in 260 A.D., some more points were added, making a total of 649 acupuncture points, including 49 single points and 300 double points. In 1027 A.D., Wei-yi Wang did an investigation along this line and supplemented with more points, reaching a total of 51 single points and 303 double points. Wang also casted the first bronze-figure to show the distribution of the meridian channels and the locations of the points. In the year of 1601, "Illustrated Bronze-Figure Ming Tang," a chart illustrating acupuncture points and meridian channels, was drawn by Wen-bing Zhao. The illustration was made on the skeleton shown from four different angles: the front, the posterior, the left, and the right posterior. The "Compendium of Acupuncture and Moxibustion" edited by Ji-zhou Yang located 667 acupuncture points, including 51 single points and 308 double points. According to the "Law for Medical Practice," published in 1742, the number of acupuncture points was further augmented to 670, including 52 single points and 309 double points. Since 1949, the technique of acupuncture treatment has been widely used in medical fields. The successful results of acupuncture anesthesia were published in 1971.

As of today, acupuncture treatment has various effects on 300 some diseases, around 100 of which acupuncture treatment has shown very satisfactory results. The effectiveness of the treatments of cardiovascular and cerebral diseases, gallstone, bacterial dysentery, etc., had not only been confirmed with modern scientific methods, but their working principles have also been giving in terms of physiology, microbiology, and immunology.

The research and clinical practice of acupuncture are not just limited to China. In fact, at around 600 A.D., the theory and clinical practice had been spread to Korea, at around 562 A.D., to Japan; by the end of 1700 A.D., to Europe. Currently, the research and its clinic practice of acupuncture can be found in more than one hundred different countries in the world; and more and more people turn to it for "magic" cure. For example, in 1994 alone, Americans made some 9–12 million visits to acupuncturists for ailments as diverse as arthritis, bladder infections, backpain, and morning sickness. And, internationally, well-known schools, such as Oxford University and University of Maryland, are involved in the fundamental research of the mechanism on why the needles really do what they were said to do. For details, see Weiss (1995).

The theory of meridians is about the structure and distribution, physiological functions, pathological changes and its relations with the organs of the human meridian system. It is a major part of the theory of Chinese traditional medicine.

The meridian system consists of two parts. One is called "Jing-Mai," which means pathways and goes up and down and connects human body's interior and exterior. This part dominates the entire meridian system. The other part is called "Luo-Mai," which means network, consists of small branches out of the Jing-Mai, and distributed crisscross all over the body.

The meridian system internally belongs to the organs, and external networks with the four limbs. It communicates between the organs and the body surface so that the human body becomes an organic whole in which Qi and Xue are so moved, and Yin and Yang are so nurtured with nutrients that the functions of each part of the body are kept harmonized and balanced. Each clinical application of acupuncture is based on this theory.

The theory of meridians had been formed more than two thousand years ago based on

(1) Clinical observations.
(2) The logic reasoning through pathological changes on the skin.
(3) Inspiration from the knowledge of anatomy and pathology.

Along with clinical observations, the points with similar curing powers are always nicely located on lines. By classifying the acupuncture point with similar functions together, the channels of meridians were gradually formed. In various clinical practices, it had been noticed that when a certain organ was not functioning normally, there would be pain under pressure, rashes, color changes, etc., at certain parts of the body. The observation and analysis of these surface pathological phenomena also helped the establishment of the theory of meridians.

Through autopsies and vivisection, ancient physicians learned the locations, shapes, and some pathological functions of the organs. And the observation of the distribution of many tubal and stringy structures and their connections with various parts in the human body has inspired the understanding of meridians.

Let us now take a look at the pathological functions of the meridian system. Meridians possess the capability of connecting internal organs and four limbs. Even though the organizational organs, including the vital organs of human body, all the limbs and bones, the five sense organs, the nine apertures, skin, flesh, muscles, etc., have their own different pathological functions, they function collectively in such a way that the interior and the exterior, the upper body and the lower body are harmonized and unified into an organic whole. All these mutual connections and collaborations are realized through the meridian system.

Meridians possess the ability to transport Qi, Xue, and nutrients throughout the body, to nurture Yin and Yang, and to protect the body from various outside attacks and invasions of diseases. All human organs need to be nurtured with Qi and Xue in order to function normally. Qi and Xue are the material foundation for all activities of living human bodies, which must be transported crisscross all over the body through the meridians.

Clinical applications of the theory of meridians consist of three parts:

(1) Explain pathological changes of diseases;
(2) Guide physicians to make correct diagnoses; and
(3) Help physicians to make efficient treatment plans.

Let us now look at each of these three parts with more details.

For the first part, when one's immune system is low, his meridians become paths for pathologic bacteria to enter the human body. When the body surface is attacked by pathologic bacteria, the ailment can be transported from the exterior to interior, from slightly discomfort to extremely serious and complicated. For example, when pathologic bacteria attack one's surface, he would experience some of the following symptoms: fever, chill, headache, body-ache, etc. Since the lungs are closely connected with the skin and hair by meridians, the pathologic bacteria will enter the dwell in the lungs through the meridians, which in turn will cause symptoms of lung diseases, including coughing, short breath, chestpain, and so on. Since the meridians establish the communications between the vital organs, and between the internal and the surface organs, they also transport illness of one part of the body to another. For instance, the heart sends heat to small intestine; liver diseases affect the stomach; stomach abnormalities interfere with the spleen. Also, the abnormalities of the internal organs can be reflected through the meridian system on the external organizational organs. For instance, liver diseases can cause pain in the upper part of the side of the human body; kidney diseases lumbago; stomach heat can cause the appearance of sores on the tongue; the heat of the large intestine or stomach can cause gum infection.

For the second part, because meridians represent related organs, they can be used as indicators of the conditions of the relevant organs. So, in clinical practice,

diagnoses can be made based on symptoms together with abnormalities of the meridians. For example, headache can be analyzed based on the distribution of meridians on the head as follows: If the pain is located at the forehead, it most likely has something to do with the yangming meridian; if the pain is on the sides, it very likely has something to do with the shaoyang meridian; if the pain is on the neck, it has something to do with the taiyang meridian; if the pain is on the top, it is likely related to the jueyin meridian. Some diseases are accompanied with abnormal reactions at some acupuncture points, including changes of skin conditions, skin temperature, and skin electric resistance. These facts are also helpful in the diagnosis process.

For the third part, acupuncture treatment is based on the needling at various points on the body to dredge the meridian Qi so that all the organs can be nurtured and balanced with Qi, Xue, and various nutrients, and consequently, the disease can either be controlled or cured. The choice of the acupuncture points is based on the definite analysis in second part above. Beside some local points, the choice of major acupuncture points is related to the distribution of the meridians. That is, when a meridian or an organ is sick, some points on this meridian or the meridians related to the organ will be used. Here, we omit some details. For interested readers, please consult with Qiu and Zhang (1985).

From this brief, yet detailed enough exposition of Chinese traditional medicine, one can see that human body is indeed a whole, a system, with different parts and organs inseparably connected. Therefore, from Lin (2007 and 2008b), it follows that each human being can be seen and studied as a spinning yoyo with its field expanding indefinitely into the space.

11.2 Tao Te: The Grand Theory of Systems About Man and Nature

The purpose of this section is to look at how humans since over 2000 years ago have been treated as systems, which are nested in the grand system of nature. In particular, if each system is a spinning yoyo, then the universe will be an ocean of spinning currents.

The concepts of Tao and Te were first introduced in the Chinese classic, named Tao Te Ching (Lao Tzu, unknown). This book is the most translated book, ever written by human, in the world. Among many reasons for the superabundance of translations are the following:

(1) This book is considered to be the fundamental text of both philosophical and religious Taoism. The Tao, or Way, is at the heart of the Tao Te Ching, and is also the centerpiece of all Chinese philosophies and thoughts;
(2) The brevity and the insights it offers make it among the few classics in the world. It is so short yet so packed with food for thought. It can be read and reread without exhausting the opportunity for obtaining new insights; and

(3) It is supposed to be, in the word of the author himself, "very easy to understand." However, when one actually tries to read it, he will realize that it is extremely difficult to comprehend the book fully.

The Tao Te Ching was written during Chou Dynasty (207–1030 B.C.) around 300–400 B.C. by a person known as Lao Tzu. Here, Tao means the Way that things should be and Te means integrity, which signifies the personal quality or strengths of an individual, one's personhood. Te is the moral weight of a person, which may be either positive or negative. Together, Tao Te means the overall character of a human being and his environment. In the literature, there was very little to be found about the author concerning who he was and what profession he was in. According to many well-documented researches, it has been believed that Lao Tzu could actually be the editor of the collection, named Tao Te Ching, of many old sayings. In Chinese history, there are so many precedents of influential thinkers being named Tzu: K'ung Tzu (Confucius), Meng Tzu (Mencius), Mo Tzu (Mecius or Macius) that one would naturally ask: What does the word "tzu" really mean? Here, tzu in Chinese has many meanings, including, "son," "pupil,", "man,", "scholar," etc. When combined with the word "lao", one of the many understandings could well be "father" in the sense of a family setting. Together with the belief that the book is a collection of old sayings, it is reasonable to say that Lao Tzu (father) is the pseudonym of the editor of the collection; and whoever is reading the Tao Te Ching, he can simply believe that he is reading the words of wisdom from his own ancestors, and guided to be a good citizen and how to live harmonically with nature.

According to many scholars of both the ancient and modern times, the Tao Te Ching is not just simply about the family teaching of children; more importantly, it was written as a handbook of ancient rulers. As for its philosophical stand(s), it is worth mentioning that there have been many different points of view about this end. The following are four main points of view (for more details, see Wu (1990)):

(1) The Tao Te Ching reflects the wishes of the then-peasants' class of private ownership;
(2) The Tao Te Ching represents the position of the then-growing class of farmers;
(3) The Tao Te Ching stands for the thoughts of the then-declining class of slave owners; and
(4) The Tao Te Ching is a book of the art of war, emphasizing on philosophical and logical education.

There is not only much in the Tao Te Ching of a mystical and metaphysical quality, and it is also a bold combination of cosmic speculation and mundane governance. In the rest of this section, we will focus on some of the ideas and concepts of modern systems theory either implicitly or explicitly contained in the Tao Te Ching. Our discussion is based on V. H. Mair's recent translation (Lao Tzu, unknown) of the manuscript, discovered at Ma-Wang-Tui site in 1973. This new manuscript can be dated much closer, which means several hundred years

earlier, to the supposed date when the classic was written than all other manuscripts used in various other translations.

In the light of modern systems research, the Tao Te Ching is a theory of a special system, consisting of and about man and his environment. This system is named Tao-Te. The Tao or the Way is about how things including man and nature should be, and Te or Integrity is about the man itself. This is evidenced in Chap. 62, "Man patterns himself on earth, earth patterns itself on heaven, heaven patterns itself on the Way, the Way patterns itself on nature." Here, it is believed that there is a single and overarching Way that encompasses everything in the universe.

Similar to modern axiom systems of scientific theories, the system of Tao-Te was introduced and studied without a definition given to either Tao or Te. "The Way is concealed and has no name" (Chap. 3). "The ways that can be walked are not the eternal Way; the names that can be named are not the eternal name. The nameless is the origin of the myriad of creatures" (Chap. 45). "The appearance of grand integrity is that it follows the Way alone. The Way objectified is blurred and nebulous. How nebulous and blurred! Yet within it there are images. How blurred and nebulous! Yet within it there are objects. How cavernous and dark! Yet within it there is an essence. Its essence is quite real; within it there are tokens" (Chap. 65). "There was something featureless yet complete, born before heaven and earth; silent—amorphous—it stood alone and unchanging" (Chap. 69). "The Way is eternally nameless" (Chap. 76). Intuitively speaking, Te represents self-nurture or self-realization in relation to the cosmos. It is in fact the actualization of the cosmic principle in the self. Te is the embodiment of the Way and is the character of all entities in the universe. Each creature has a Te which is its own manifestation of the Tao. Tao represents cosmic unity, while Te stands for the individual personality or character. The Tao Te Ching portrays the absorption of the separate soul into the cosmic unity, it describes the assimilation of the individual personality (Te) into the eternal Way (Tao). In simplest terms, Te means no more than the wholeness or completeness of a given entity. It represents the selfhood of every being in the universe. It also has a moral dimension in the sense of adherence to a set of values. From Tao, the vast variety of creatures and things in the world spring. Contrary to the existence or being of all the things or beings in the world, the Tao, their origin, is without existence. In terms of general systems, Tao represents the system, while Te stands for the attributes of each member of the whole; and the theory of the system Tao-Te depicts how the members and the whole are connected in such a way that the whole system could be in a chaos or in harmony.

One of the features of systems, as studied in our modern time, is the structure of layers. That is, an object B of a system A can be a system itself; an object C of the system B can be a system again, …, see Lin and Ma (1987) for details. This kind of layer structure can be seen at many different places in the Tao Te Ching. For example, "When the Way is lost, afterward comes integrity. When integrity is lost, afterward comes humanness. When humanness is lost, afterward comes righteousness. When righteousness is lost, afterward comes etiquette" (Chap. 1). "Preeminent is one whose subjects barely know he exists; the next is one to whom they feel close and praise; the next is one whom they fear; the lowest is one whom

they despise" (Chap. 61). Related to the concept of layers of systems, if one ignores the parts of members of the systems, then the structure of relations can be seen as stratifiable. This idea is contained in Chap. 62: "When the great Way was forsaken, there was humanness and righteousness; when cunning and wit appeared, there was great falsity; when the six family relationship lacked harmony, there were filial piety and parental kindness; when the state and royal house were in disarray, there were upright ministers." In terms of systems, it says that if the high level structure is difficult to control or to study, a lower level will always be there.

The concept of process, which involves the notion of time, has been studied by many scholars, including some of the greatest minds in the history, such as Newton, Poincare, Einstein etc. In terms of systems, the concepts of time systems (Mesarovic and Takahara 1974, 1989; Lin and Ma 1987a) and tree-like hierarchy of systems (Lin 1988b, 1990) have been introduced and studied from many different angles. As a matter of fact, concepts, related to that of process, can be seen at various places in the Tao Te Ching. For instance, Chap. 5 contains the following: "The Way gave birth to unity, unity gave birth to duality, duality gave birth to trinity, and trinity gave birth to the myriad creatures. The myriad creatures bear Yin on their backs and embrace Yang in their bosoms. They neutralize these vapors and thereby achieve harmony." In the words of von Bertalanffy, the Whole was created first. By looking at the Whole, some objects and relations among the objects become dominating, which in turn gave birth to "duality." Now, the Whole, the collection of the objects, and the entirety of the relations constitute the "trinity." This Trinity is the fundamental structure of all the things and beings in the universe. In the words of ancient Greek atomists, Lavoisier, Einstein, or the laws of conservation, the Way is constant while all other things will vary at the level of the Trinity according to the observations of a third entity. Based on the research of pansystems, Lao Tzu had used the idea of general symmetric relations to describe the relation between gentle and dramatic changes, the general symmetric process of the gradual development from the chaotic Qi (vapor) to the creation of myriad creatures. For more details, see Wu (1990). In the point of ruling a state, Lao Tzu's statement describes the fact that only with a clear view of the Way, there will be a stable, peaceful and prosperous country, which is called the unity. The stable and peaceful environment furnishes the prerequisite and the potentiality (the duality) for the development of myriad societal events. Even though the existence of the myriad societal activities or entities is mutually constrained or self-contradictory, it is the existence of these myriad mutually constrained and self-contradictory activities and entities that the whole or the country is in a balanced prosperity. In terms of systems research, only under the condition that a system exists, the entireties of objects and relations will possess their meanings. With the definite system, its objects, and relations, it becomes reasonable to study the myriad properties and structures of systems.

One of the important structures of general systems is the center. In 1956, Hall and Fagen (1956) introduced the concept of centralized systems, where a centralized system is a system in which one object or a subsystem plays a dominant role in the operation of the system. The leading part can be thought as the

center of the system, since a small change of the part would affect in some way the entire system, causing considerable changes. As for how to form a centralized system, the Tao Te Ching has the following teaching (Chap. 2): "Now, for this reason, Feudal lords and kings style themselves 'orphaned', 'destitute', and 'hapless'. Is this not because they take humility as their basis?" "That which all under heaven hate most is to be orphaned, and hapless. Yet kings and dukes call themselves thus" (Chap. 5). That is to say, in order to form a centralized system, the "center" or the leading part must have harmonic relations or connections with the rest of the system. This conclusion coincides with the main result in (Lin 1988a).

When more than one system appears in the study of general systems, one of the first things that need to be done is to compare the systems under consideration. The study of the concepts of functions and mappings in mathematics is a good example. In the research of general systems, the concept of mappings between systems can be seen in several different places, such as Cornacchio (1972) and Lin (1991). The need of comparison was phrased by Lao Tzu in the following way (Chap. 17): "Observe other persons through your own person. Observe other families through your own family. Observe other villages through your own village. Observe other states through your own state. Observe all under heaven through all under heaven."

The scientific history has shown the facts that systems are everywhere, and that nowhere has no systems. A great treatment on these facts is Bunge (1977). Accompanying these facts, in the past half century, the concept of systems has been applied to the study of all corners of human knowledge, see, for example, Klir (1970) and Wu (1990). Meanwhile, the research of general systems has shown some technical problems. In short, it is extremely difficult to develop some of the fundamental concepts in the theory of general systems, such as the concept of general systems. For details, see Wood-Harper and Fitzgerald(1982). All these phenomena had been vividly presented in the Tao Te Ching as follows (Chap. 79): "When the Way is expressed verbally, we say such things as 'how bland and tasteless it is!' 'We look for it, but there is not enough to be seen.' 'We listen for it, but there is not enough to be heard'. Yet, when put to use, it is inexhaustible!"

R. Descartes and Galileo developed the following methods about scientific research and administration individually: Divide the problem under consideration into as small parts as possible, and study each of the isolated parts (Kline 1972), simplify the complicated phenomenon into basic parts and processes (Kuhn 1962). In the history of science and technology, Descartes' and Galileo's methods have been very successfully applied. They guaranteed that physics had won great victories one by one (von Bertalanffy 1972). Why are the methods so powerful? According to Lao Tzu, we have the following (Chap. 26): "Undertake difficult tasks by approaching what is easy in them; do great deeds by focusing on their minute aspects. All difficulties under heaven arise from what is easy, all great things under heaven arise from what is minute. For this reason, the sage never strives to do what is great. Therefore, he can achieve greatness." Not only does it tell why Descartes' and Galileo's methods work, but also does it teach the relation between parts and the whole being a higher level structure than all parts.

Combining what has been done in the previous two sections, we truly hope that we have convinced our reader that each human being is a system, a spinning yoyo field, and that the universe is indeed an ocean of eddy fields of different scales spinning at various intensities. These eddy fields push against each other, penetrate each other, and interfere in each other's affairs. That is, the state of motion of any yoyo field is determined by its own internal structure and by the interactions with other fields. With these background results laid out, we are ready to look at the systemic structure of self-awareness.

What is shown above is how since the ancient times, the human body has been seen as a system, how it is organically connected to the environment, and how the universe is a huge system made up of many small systems.

Chapter 12
The Four Human Endowments

The totality of each human being is of four-dimensional: body, mind, heart, and spirit. It is physically made up of flesh, bone, blood, hair, and brain cells, and systemically of self-awareness, imagination, conscience, and free will (Covey 1989 p 70). By using self-awareness, he is able to examine his own thoughts and has the freedom to choose his response to whatever he comes across or whatever is imposed on him. With imagination, he is able to create a (fantasy) world in his mind beyond the present reality. With conscience, he is deeply aware of what is right and wrong, of the principles that govern his behavior, and a sense of the degree to which his thoughts and actions are in harmony with the principles. And he has free will to act based on his self-awareness, free of all other influences.

In this chapter, we use the systemic yoyo model (Lin 2007) to provide new insights as for what the human endowments—self-awareness, imagination, conscience, and free will—are and to address some of the very important questions related to the phenomenon of these human endowments. Our work here and those contained in the following chapters of this book indicates that as is expected in (Lin 2007), the systemic yoyo model can indeed be equally employed to study such "exact" science as physics and the study of such "inexact" science as social science and humanities. Not only so, discussions in these chapters also imply that the thinking logic of this model can be powerfully utilized to produce convincing results about human behaviors. This work provides a brand new theoretical foundation for resolving some of the very important age-old problems widely studied since the dawn of the Western philosophy. Some of the results obtained herein are expected to produce immediate real-life benefits in terms of designing educational programs. This chapter is mainly based on (Lin and Forrest, to appear 1 & 2).

More specifically, based on what is analyzed in the previous chapter, in Sect. 12.1, we investigate the phenomenon of self-awareness by addressing the following questions:

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1. Where is human self-awareness or self-consciousness from?
2. Why does each human being have its very core of his/her own identity?
3. How is self-consciousness used to examine one's own thoughts and to choose appropriate actions in response to specific circumstances?
4. How are individual self-awareness and the cultural emphasis on the importance of self-consciousness related?
5. How can the systemic yoyo model be employed to explain the reason why individuals maintain different degrees of self-motivation and self-determination?

Among many interesting results, we show that since each human, seen as a systemic spinning yoyo, breaths in and out materials, it constantly battles with other systems by pushing against each other and attracting toward each other. The constant battles between human systems collectively make them aware of their own existence, the existence of others, be they human beings or objects, and their private thoughts. At the same time when individual self-awareness naturally exists with each human being, the cultural emphasis on the importance of self-consciousness in general influences how much its citizens focus on and act according to their individual understanding of various matters. Also, we clearly demonstrate the following important result: when the systemic structure of a person is uneven with its component materials, his yoyo structure will more likely spin on its own, and that the more uneven the yoyo structure is, the more driven, or more self-motivated, or more self-determined the person will be. That is, instead of being innate, self-motivation and self-determination are functions defined by hardships and knowledge of the opposite possibilities.

In Sect. 12.2 on imagination, we look at the following problems:

1. Is there any underlying mechanism over which the human imagination works and functions in its action and process to imagine, to form mental images or concepts of what is not actually present to the biological sense organs?
2. How does the innate ability to imagine help each of us form personal and individually different philosophical value and belief systems within our minds based on elements derived from sense perceptions of the shared physical world?
3. Is Albert Einstein (1987) right when he said, "Imagination…is more important than knowledge"?
4. How does the workshop of the human mind—imagination—practically work to reassemble known ideas and established facts for innovative uses?
5. Why is imagination so powerful that it can convert adversities, failures, and mistakes into assets of priceless value, leading to the discovery of some of the underlying truths, known only to those who use their imagination?

Among other results, we show that imagination is the collection of all the conscious (meaning through the sense organs) and unconscious (meaning not through any of the sense organs) records of the interactions between the underlying yoyo fields. When one needs to establish an abstract image or concept, he relies on

his various trainings to tap into his reservoir of imagination and make matches between some of the recorded patterns and the desired concept, product, or service. And the way we form our personal, individually different philosophical value and belief systems, is similar to how a civilization forms its underlying assumptions and values of philosophy. When one experiences an adversity, a failure, or made a mistake, our analysis indicates that he experiences one of the following situations: facing great resistance, being completely stopped temporarily, or having taken a regretful choice. If a person is able to tap deeply into his imagination, then he can find out how to avoid the same situation from happening in the future and/or how to take advantage of similar situations in the future.

In Sect. 12.3 in terms of conscience, we address:

1. Where is conscience from? Why can it help distinguish whether an action is right or wrong?
2. Why is conscience deeply aware of the principles that govern one's behavior and a sense of the degree to which his thoughts and actions are in harmony with the principles?
3. How are the contents of his conscience affected by the culture?
4. Could the concept of world conscience possibly hold true and actually work so that one day in the future people can eventually make decisions based on what is beneficial to all people?

By using our systemic yoyo modeling, it is found that conscience is a partial function with two output values defined on some of the spin patterns and interactions of these patterns of imagination, where certain kinds of field flows and interactions of the flows are assigned the value of +, known as being right or moral, and some other kinds of flows and interactions assigned the value of −, known as being wrong or immoral. Based on this understanding, we show among others that the capacity for conscience is genetically determined, while the subject matter of conscience is learned. Our discussion demonstrates that conscience does not stands for the reason that addresses whether right or wrong, and explains why underneath the rich varieties of contents of individual consciences in a society, there is obvious commonalities when compared to other societies. We also show that the concept of world conscience will not ever become true.

In Sect. 12.4, we use the yoyo model to address several problems related to free will:

1. What is the systemic mechanism for the existence of the human endowment free will?
2. Does rational agent actually exist? If they do, when do they experience uncertainties in their decision-making?
3. Are all laws of nature causally deterministic? Is there such a thing as freedom in the reality?
4. Does moral responsibility require free wills of people? How are individuals morally responsible for their conducts?

It is shown that free will is the human ability to predict at least for the short term what one can or cannot accomplish and what choices are better or the best for the situation involved. Here, where his self is located, inside the domain of the ± function or outside the domain, determines how he would behave in terms of making and keeping promises. Using the commonly accepted definition of rational agents, we show in terms of whole evolutions that no human being or firm can be rational due to limitations in our knowledge and the development of technology, and that in the physical reality, there does not exist such a thing as freedom in absolute terms. As for moral responsibility, our work indicates that each individual or a small group of individuals has to be morally responsible for the well-being of their society, otherwise this individual or small group of individuals will be run over by other people or elements of the society mercilessly.

12.1 The Phenomenon of Self-Awareness

By self-awareness it means the human awareness that one exists as an individual and an entity that is separate from other people and objects with private thoughts and individual rights (Cooke 1974, p. 106). It also includes the understanding that other people are similarly self-aware. Self-awareness is a self-conscious state in which attention focuses on oneself. It makes people more sensitive to their own attitudes and dispositions (Branden 1969, p. 41).

At various circumstances, self-consciousness is used synonymously with self-awareness. It is credited only with an individual's development of identity. That is, in terms of epistemology, self-consciousness is a personal understanding of the very core of one's own identity. It is during the times when self-awareness or self-consciousness is awakened that people come to knowing themselves. Jean-Paul Sartre (June 21, 1905–April 15, 1980), a French existentialist philosopher and one of the leading figures in twentieth century French philosophy (Gerassi 1989), describes self-consciousness and self-awareness as being non-positional; it is not attached to any particular location.

With the utilization of self-consciousness, people examine their own thoughts and have the power to choose their responses to whatever situations they are faced with. That is why it is often observed that when someone loses himself/herself in a crowd, he/she may very well act totally untypical of the person. Self-consciousness or self-awareness is the basis for individuals traits, such as accountability, including responsibility, answerability, enforcement, blameworthiness, liability, and other terms associated with the expectation of account-giving (Schedler 1999), and conscientiousness, which stands for the trait of being painstaking and careful, or the quality of acting according to the dictates of one's conscience. Self-consciousness includes such elements as self-discipline, carefulness, thoroughness, organization, deliberation (the tendency to think carefully before acting), and need for achievement (Salgado 1997).

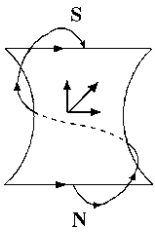

Fig. 12.1 Slanted meridians of a yoyo structure

With different degrees of ability to mobilize their self-consciousness, people are greatly affected by their own self-awareness, as some people scrutinize themselves more than others. And the importance of self-consciousness is emphasized differently from one culture to another. Even so, individuals maintain a varying degree of self-motivation and self-determination (Cohen 1994, p. 136).

Question 12.1 Where is human self-awareness or self-consciousness from?

For any person, his self-awareness is really a natural consequence of his underlying multi-dimensional systemic yoyo structure. Specifically, in theory, we can think of the totality of all materials that can be physical, tangible, intangible, or epistemological, and that all these matters are contained in the systemic yoyo of the person, if he is situated in isolation from other yoyo structures. That is, he is a whole being of his own. However, in reality no man lives in isolation; systems are of various kinds and scales; and the universe can be seen as an ocean of eddy pools of different sizes, where each pool spins about its visible or invisible center or axis. To this end, one good example in our three-dimensional physical space is the spinning field of air in a tornado. In the solenoidal structure, at the same time when the air within the tornado spins about the eye in the center, the systemic yoyo structure continuously sucks in and spits out air. In the spinning solenoidal field, the tornado takes in air and other materials, such as water or water vapor on the bottom, lifts up everything it took into the sky, and then it continuously sprays out the air and water from the top of the spinning field. At the same time, the tornado also breathes in and out with air in all horizontal directions and elevations. If the amounts of air and water taken in by the tornado are greater than those given out, then the tornado will grow larger with increasing effect on everything along its path. That is the initial stage of formation of the tornado. If the opposite holds true, then the tornado is in its process of dying out. If the amounts of air and water that are taken in and given out reach an equilibrium, then the tornado can last for at least a while. In general, each tornado (or a systemic yoyo) experiences a period of stable existence after its initial formation and before its disappearance.

Because each person is a system with his own yoyo structure, he also constantly takes in and spits out materials. As influenced by the eddy (horizontal) spin, the meridian directional movement of materials in the yoyo structure is actually slanted instead of being perfectly vertical (Fig. 12.1). In this figure, the horizontal vector stands for the direction of spin on the yoyo surface toward the reader and the vertical vector the direction of the meridian field, which is opposite of that in

which the yoyo structure sucks in and spits out materials. Other than breathing in and out materials from the black hole (we will call it the south pole of the yoyo) and big bang (it will accordingly be named as the north pole of the yoyo) sides, the yoyo structure also takes in and gives out materials in all horizontal directions and elevations, just as in the case of tornadoes discussed earlier.

In the process of taking in and giving out materials, formed is an outside surface of materials that is mostly imaginary of our human mind; this surface holds within its boundary most of the contents of the spinning yoyo. The density of materials of this surface decreases as one moves away from the yoyo structure. The maximum density is reached at the center of the eddy field. As the spin field, which is the field of the combined eddy and meridian fields, constantly takes in and gives out materials, there does not exist any clear boundary between the yoyo structure and its environment, which is analogous to the circumstance of a tornado that does not have a clear-cut separation between the tornado and its surroundings.

Now, this description of the general yoyo structure of a human being provides a fundamental theoretical explanation for where human self-awareness or self-consciousness is from. In particular, because each system breaths in and out materials throughout each part of its surface area, between different systems, there is a constant battle for

1. Pushing against each other when materials that are emitted outward are thrown against each other. This is how each person feels that he is separate from other people and objects. And
2. Attracting toward each other when different systems try to absorb a piece of material of common interest. This is how the feeling of individual rights and entitlements is created.

These constant battles between systems collectively make them aware of their own existence, the existence of others, and their private thoughts, be they human beings or objects. Of course, the strength of such self-awareness is determined by the intensity of individual yoyo's spin field.

The reason why each person focuses on himself, is sensitive to his own attitudes and dispositions is because his very own viability is at stake, where his viability is determined by how strong his yoyo field spins and how much and how effectively the field can absorb materials from the environment.

Question 12.2 Why does each human being have its very core of his/her own identity?

The answer to this question lies in the fact that each person is the three-dimensional realization of a multi-dimensional field, which spins about its invisible axis, where the axis of spin stands for the center and core of his identity. Similar to the situation of identity search of civilizations (Lin and Forrest, to appear c), when person *N* feels inferior comparing to person *M*, sooner or later *N* will want to improve himself by adopting elements, such as a different way of looking at things, a specific philosophical point of view, or a new system of values,

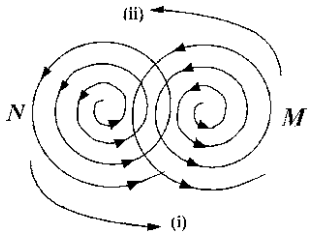

Fig. 12.2 Acting and reacting spin fields of system *M* and a neighboring system *N*

from the yoyo structure of *M*. As the change in *N* brings forward greatly wanted benefits, such as social status improvement, increased earning power, etc., the process of wanting to be just like *M* starts to reverse with the original sets of philosophical principles and values being revived. Further improvement in *N* weakens the influence of *M* and strengthens the commitment of *N* to its original being in two ways. At societal level, the economic benefits of personal improvement enhance *N*'s social status so that *N* gains confidence in himself and becomes socially assertive. At individual level, the voluntary improvement destroys original connections between different items in *N*'s value system, among his philosophical principles, and the way he used to connect with the outside world, leading to crises of identity. Because of the crises, *N* turns to religion. That is, person *N* selectively borrows items from other people and adapts, transforms, and assimilates them so as to strengthen and insure the survival of the core values of his own belief system.

Question 12.3 How is self-consciousness used to examine one's own thoughts and to choose appropriate actions in response to specific circumstances?

As what we have seen earlier, self-consciousness comes into being from the constant battles of the systemic yoyo structure of one person against all other spinning fields from the environment. In particular, when person *N* (Fig. 12.2) battles with the spin field of another yoyo field *M*, *N* starts his engagement in the interaction with *M* gradually so that over time, *N* adjusts itself to better handle the interaction in order to maintain its own viability as a system. When *N* constantly interacts and battles with many systems at the same time, it learns and remembers how it adjusted itself to face various interactions to produce the desirable outcomes. So, when a new situation appears, *N* naturally associates it to one or a set of previous similar scenarios and tries to mimic the same reactions as before in hope of predicting similar desirable outcomes. This systems modeling explains why when one suddenly faces a completely new difficulty or challenge, he tends to be panicky or experience anxiety. In such a situation, a more mature person would temporarily stop what he is working on at the very moment and organizes his thoughts and takes his time to come up with a most suitable reaction by utilizing his other three human endowments: imagination, conscience, and free will. What separates this more mature person from other relatively immature people is that through his various battles and interactions with other yoyo fields, he has gained a

better understanding of himself and others. That is, he has accumulated a rich deposit of knowledge and experience and developed a better ability to command over the elements in the deposit so that he can refer back to them as freely and as many times as he needs to.

Question 12.4 How are individual self-awareness and the cultural emphasis on the importance of self-consciousness related?

To address this problem, let us first look at how cultures are formed by treating each culture and every social organization as an abstract, high-dimensional spinning yoyo. First, the geographic feature of each specific land always has its individuality, and unshared characteristics. For example, Europe is mainly surrounded by oceans and has rivers well distributed throughout the land; and China is enclosed by deserts or extreme natural conditions in the north, cold, mountainous, and dry yellow-earth plateau in the west, the Himalayas in the southwest, lush jungles in the south, and open seas in the east. And throughout much of the land, people depend on one of the two river systems, the Yellow River and the Yangtze River, to survive. As what (Lin and Forrest, to appear a) discovered, different geographic characteristics of natural environments make people living on different lands hold different sets of philosophical principles and views of the world. For example, the openness in the geographic characteristics of Europe made Europeans accustomed to open thinking and freedom of movements (or individualism) due to the reason that they did not and will not have much need for difficult negotiation and compromise with anyone. On the other hand, because the geographic environment and condition of China more resembles that of the spinning dish used in Fultz's dishpan experiment with only the east open to large bodies of water. However, in ancient times without much capability to travel overseas, China was completely situated in a "dish with a solid periphery." So, the Chinese civilization is a perfect realization of a high-dimensional spinning yoyo (of fluids), in which Chinese history is pretty much a social version of the periodic pattern changes observed in the dishpan experiment, where as a nation, it has gone through divisions and unifications alternately. So, throughout the history, collectivism has been the core of Chinese philosophical value, around which Chinese people have been patient with difficult negotiations and compromises.

Now, let us turn our attention to addressing Question 12.4. Because personal ability of self-awareness exists naturally with the underlying systemic yoyo structure of a person, and the underlying yoyo is surely situated in the spin field of the culture in which the person lives, since the very moment when the yoyo structure of the person is formed in the well controlled area between the spinning pools of his parents (Fig. 12.3, where not all possibilities are shown), the content of his self-awareness and how he sees everything in the environment by using his self-awareness have been greatly affected by the value system of the family and the underlying philosophical principles and values of the culture. That is, individual self-awareness itself, as an ability and human endowment, naturally exists with each human being no matter where he lives. However, how the environment and world is seen within the self-awareness is greatly tinted by the fundamental

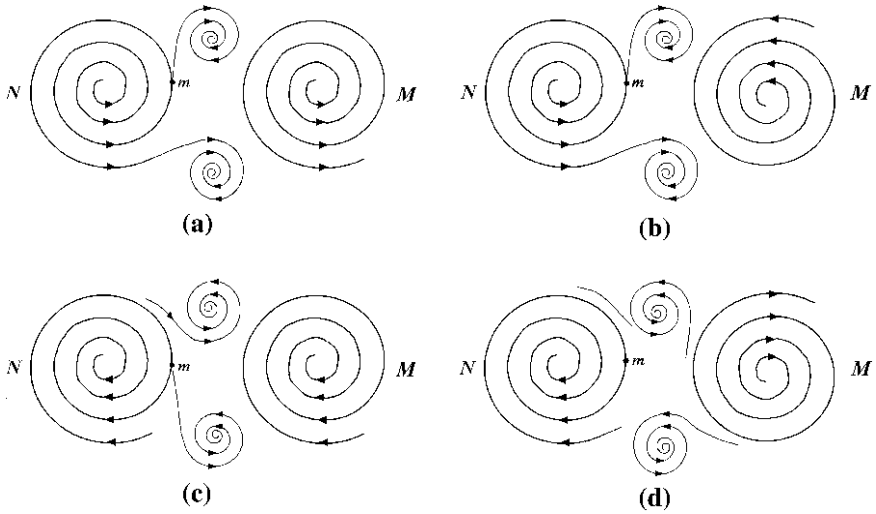

Fig. 12.3 *N* and *M* jointly produce subeddies in areas of their control. **a** Subeddies created by two diverging yoyos. **b** Subeddies created by one convergent and one divergent yoyos. **c** Subeddies created by two converging yoyos. **d** Subeddies created by one convergent and one divergent yoyos

philosophical principles and value system of the culture. That is, the cultural emphasis on the importance of self-consciousness in general influences how much the citizens focus on and act according to their individual understanding of various matters. For instance, in a culture that values individualism, the citizens would tend to focus more on their own roles in various affairs and the effects on their personal well beings of different events. On the other hand, in a culture that emphasizes on collectivism, the citizens would more likely place potentially organizational benefits over their personal gains, including the extreme case that they might have to sacrifice their lives to bring about the potential organizational benefits for others.

Question 12.5 How can the systemic yoyo model be employed to explain the reason why individuals maintain different degrees of self-motivation and self-determination? (This problem has been looked at by many scholars from various angles. However, as of this writing, still no satisfactory answer is derived. For details, see Colvin (2008) and references found there)

To address this problem, first let us model the meaning of self-motivation and self-determination as follows: If a yoyo spins on its own without much push or pressure (or no push or pressure at all) from the environment, then we say that the yoyo structure is self-motivated or self-determined. As for the degree of self-motivation and self-determination, it stands for the strength or intensity of the spin of the yoyo field. With this systemic modeling in place, the answer to Question 12.5 lies with the very reason why materials in the universe rotate in the first place.

According to the concept of uneven space and time of Einstein's theory of relativity (1987), we know that all materials have uneven structures. Out of these uneven structures, there naturally exist gradients. With gradients, there will appear forces. Combined with uneven arms of forces, the carrying materials will have to rotate in the form of moments of forces (Lin 2008b, p. 31). With this reason on why materials in the universe rotate in the first place and continue to do so, we can readily see that when the yoyo structure of a person is made up of uneven materials, his yoyo structure will more likely spin on its own, and that the more uneven the yoyo structure is, the more driven, or more self-motivated, or more self-determined the person will be. This end in fact very well illustrates why people who grew up in difficult environments and knew the existence of better living conditions or who have lived in a rich variety of drastically different environments tend to have greater motivations or ambitions in life than those who grew up in monotonic comfort.

Our discussion here also indicates that for any chosen person, his self-motivation and self-determination of whatever degree is determined during his life time by the levels of difficulties he encounters and the accompanying knowledge of good quality of lives, especially during his childhood when minor discomforts can easily amount to major crises in life. So, instead of being innate, self-motivation and self-determination are functions defined by hardships and knowledge of the opposite possibilities.

12.2 The Systemic Structure of Imagination

By imagination, it means the faculty of the human mind to imagine, to form mental images or concepts of what is not actually present to the biological senses, and the action or process of forming such images or concepts. With this faculty of the mind, one derives meaning to experience and understanding to knowledge. It is a fundamental human endowment through which people make sense of the world (Norman 2000, pp. 1–2) and plays a key role in the learning process (Egan 1992, p. 50).

Only through imagination, we encounter everything in life. Whatever we touch, see, and hear coalesce into a mental picture via the faculty of imagination. The ability to imagine is the innate ability through which we form our complete personal philosophical value and belief systems within the mind based on elements derived from sense perceptions of the shared physical world (Harris 2000, p. 94).

The common use of the term imagination is for the process of forming in the mind new images not previously experienced either partially or in different combinations. In this sense, imagination not being limited to the acquisition of exact knowledge is free from objective restraints. For example, the ability to imagine one's self in another person's place is very important to social interactions and mutual understanding. Albert Einstein (1987) said, "Imagination…is more important than knowledge. Knowledge is limited. Imagination encircles the world." The most famous technological/informational inventions and

entertainment products in the entertainment business have been created from the inspiration of human imagination.

Imagination is the workshop of the human mind, in which known ideas and established facts may be reassembled into new combinations and put into new uses and it is known as the creative power of the human soul (Hill 1928, p. 131). For example, to have a purpose in life, to establish self-confidence, to be proactive, and to take on leadership roles, one has to first create these qualities in his imagination and foresee the potential of him actually possessing them.

Any tangible achievement in life generally grows out of one's imagination. He first forms the thought in his imagination, then organizes the thought into realistic ideas and implemental plans in his mind, and then, and only then, physically transforms those mental ideas and plans into the reality. As soon as a thought germinates in the mind, the interpretative and creative nature of the imagination begins to examine relevant facts, concepts, and ideas; at the same time, it creates new combinations and plans out of these facts, concepts, and ideas. Through its interpretative ability, the imagination registers mental vibrations and thought waves, by which the physical body as dictated is put into motion by making use of the various outside available resources. Imagination is the only thing in the world over which we have absolute control. Even although one might be deprived of different privileges, rights, and properties, such as honors, individual freedom, or wealth, and he might be cheated upon in many different ways, there is no one in the world who can deprive him of the control and use of his imagination (Hill 1928, p. 131).

When one properly uses his imagination, he will be able to convert his adversities, failures, and mistakes into assets of priceless value. It will lead him to the discovery of some of the underlying truths, known only to those who use their imagination. That is why it has been shown time and again that the greatest reverses and misfortunes in life often open the door to golden opportunities (Hill 1928, p. 138). For instance, if you want to know what a certain fellow would respond to a specific circumstance, use your imagination, put yourself in his place, and find out what you would do under the same circumstance. That is the imagination in action (Hill 1928, p. 142).

Question 12.6 Is there any underlying mechanism over which the human imagination works and functions in its action and process to imagine, to form mental images or concepts of what is not actually present to the biological sense organs?

Going along with the systemic yoyo model of self-awareness, the human endowment—imagination—is also a natural consequence of the human yoyo structure. Because biological sense organs are simply the body parts of the 3-dimensional realizations of the underlying multi-dimensional spinning fields of human yoyos, a great deal of the field structures of the world these sense organs cannot really pick up. From the fact that each human yoyo constantly interacts with other spin fields in the forms of pushing against each other or grabbing over materials of common interests, it follows that the experience and knowledge gained from the human field interactions are much richer than what is known based

on the information collected by the sense organs. This end provides a systemic model for human imagination. That is, the so-called human imagination is in fact the collection of all the conscious (meaning through the sense organs) and unconscious (meaning not through any of the sense organs) records of the interactions between the underlying yoyo fields. When one needs to establish an abstract image or concept, he relies on his various trainings to tap into this reservoir of experience and knowledge collected both consciously and unconsciously from his field interactions with others. Here, the level of training on his self-awareness determines how deeply he can reach into this reservoir. Consequently, it determines how thought provoking his established concepts and images will be.

It is shown in (Lin 2008a) that the material world and human thoughts share the same structure, the yoyo field structure. So, when human imagination is called for action, it simply matches what is given, be it a difficult problem, a challenging situation, or a difficult task, with some of the relevant knowledge or experience from the reservoir. If the match is nearly perfect, the action will be considered successful. If the match is not good or no match is found, then new experience or knowledge will be added into the reservoir. Remember, this reservoir is composed of two parts. One part is the collection of all learned knowledge and experience through the sense organs; and the other the collection of all knowledge and information collected not through the sense organs. With adequate training on self-consciousness, one can "magically" apply a great deal of materials out of the reservoir of his imagination.

Question 12.7 How does the innate ability to imagine help each of us form personal and individually different philosophical value and belief systems within our minds based on elements derived from sense perceptions of the shared physical world?

From the discussion above that addresses Question 12.6, it follows that our ability to imagine, which is the ability to match a realistic situation with what is in the reservoir of imagination, is indeed innate. We were born with such a capability, just as we naturally knew we needed to eat when we were hungry. As for how through using imagination, we form our personal, individually different philosophical value and belief systems within our minds based on elements derived from sense perceptions of the shared physical world, it is similar to how a civilization, a human organization of the largest scale, forms its underlying assumptions and values of philosophy. In particular, at the time when a person is born, he lives in an extremely primitive condition and passively receives whatever is provided to him from the parents and the limited environment. From these initial contacts and interactions with the outside world, the newborn forms his elementary beliefs, basic values, and fundamental philosophical assumptions, such as "I am here for you to take care of me," "You have to satisfy my needs; otherwise, I blame you for the consequence," etc.

Since the underlying yoyo field interactions are very basic and the parents nurture the newborn, the fundamental structure of the newborn's yoyo field is mainly formed through the interactions with the parents. Due to physical and

mental limitations, minor obstacles of life make the newborn completely dependent on the parents. So, over time as he naturally formed a value system and a set of philosophical assumptions, on which he reasons in order to obtain what he wants, to explain whatever inexplicable, develops approaches to overcome hardships, and established methods to administrate his personal affairs. As time goes on, he acquires more tools and knowledge from different sources in much greater environment. As all the learned (either consciously and unconsciously) knowledge that are from either sense organs or the invisible yoyo fields start to connect and form understandings of higher levels, some kinds of circulations of knowledge and information begins to form within the content of his self-consciousness and the reservoir of his imagination. As soon as a circulation appears, Bjerknes's Circulation Theorem guarantees the appearance of abstract, multi-dimensional eddy motions within the content of the person's self-consciousness and the reservoir of his imagination. That explains how imagination helps each of us form personal philosophical value and belief systems within our minds based on elements derived from the interactions between our spin fields and the fields existing in the shared physical world. As for why our value and belief systems are different from one another, it is because our spin field structures are not identical to each other so that the interactions of our individual fields with the fields of the shared world are different. Sometimes, the differences can be drastic. This end illustrates why children growing up in different families tend to have different value and belief systems and why children growing up even in the same households turn out to be different from one another in their value and belief systems. In the later case, although the children grow up in the same households, each of them experiences through quite different field interactions with the environments. In particular, in a household of two parents the oldest child grows up with two adults taking care of him; the second child with three beings running around about him with one of the three competing with him; …

Question 12.8 Is Albert Einstein (1987) right when he said, "Imagination…is more important than knowledge"?

Based on the analysis earlier, the answer to this question depends on what Einstein means when he uses the words "imagination" and "knowledge." If to him imagination means one's ability to deeply reach into his knowledge base, which is composed of all the conscious and unconscious records of the interactions between the underlying yoyo fields, and to collect and organize all of the relevant information, and knowledge the collection of facts and theories gained through sense organs, then Einstein is correct. On the other hand, if both of the words "imagination" and "knowledge" stand for the same thing, the totality of all the conscious and unconscious experience and records of the interactions between the underlying yoyo fields, then Einstein did not say anything worthwhile discussing.

Question 12.9 How does the workshop of the human mind—imagination—practically work to reassemble known ideas and established facts for innovative uses?

For each purposeful innovation or invention, the person involved generally has an idea about what he is looking for. Because the material world and human thoughts share the same structure—the yoyo field structure (Lin 2008a), the level of training the person has gone through in the past helps him to make matches between the patterns stored in his imagination and the desired concept, product, or service he is looking for. Here, the ability to reassemble different patterns available in one's head in various desired ways separate inventors and manufacturers. Also, what is concluded here is that for an innovation to take place or an invention to be made there must be such a person that he is a visionary who can spot the need for something different and new. After he mentally goes through the idea numerous times either alone or collectively with others and is fully convinced that such an innovation is truly needed, he then passes on his mental image to another person, whom might be called a craftsman or engineer, who has the ability to materialize the imagined new concept, product, or service. In earlier days, the visionary and the craftsman tend to be the same person. However, in our modern times where science and technology are highly advanced and sophisticated, the visionary and the engineer tend to be different entities. And each is often plural and contains a team of able bodies. When a team of engineers is involved, each member of the team contributes to the effort by providing his individual design. After the brainstorming, all the individual designs are pooled together to form the best and the potentially most realizable prototype. That is, the individual imaginations of the members of the team are combined together to produce the desired product at a much higher level than any of the original, individual designs.

For accidental inventions, the word "accidental" speaks the meaning. That is, the person involved in the process accidentally observes or recognizes a useful pattern out of the available information in his imagination. After that, engineers actualize the pattern into practically usable entity.

Question 12.10 Why is imagination so powerful that it can convert adversities, failures, and mistakes into assets of priceless value, leading to the discovery of some of the underlying truths, known only to those who use their imagination?

The power of imagination is entailed in the fact that imagination is the reservoir of all the records of interactions of the spin field of a person with the fields of all other systems in the environment. In order to address this question well, let us first look at the systemic models for the concepts of adversities, failures, and mistakes, respectively.

Imagine that a systemic yoyo K interacts with another yoyo H (Fig. 12.4). Because each of the spin field extends infinitely into the space, each of the yoyos is in actuality situated entirely in the spin field of the other yoyo. As indicated in the boxed areas, the interacting fields in these regions flow against each other. So, if a small yoyo m is flowing along the field of yoyo H in the left boxed area in Fig. 12.4a or in the left side of the boxed area in Fig. 12.4b in the upward direction, then yoyo m is experiencing an adversity, because its desire of moving upward is facing great resistance from yoyo K. If the desired upward movement of m in one of the said area is completely stopped by the downward push of yoyo K,

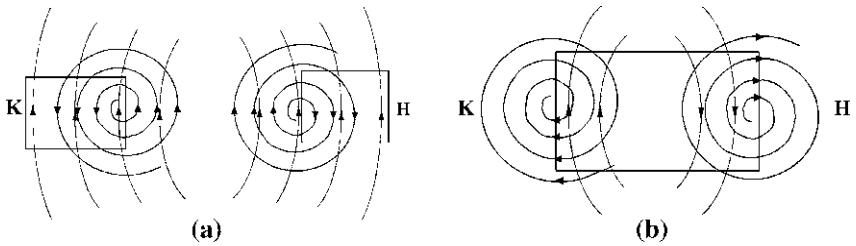

Fig. 12.4 Interaction between two spin yoyos

then m experiences a failure. If yoyo m in the said areas takes the new direction of flow of yoyo K because in the said region K seems to be more powerful, it is possible that later on when m is traveling in some other part of the field of K it realizes that it did not like the way it is forced to comply with a completely new set of rules. Then, this post-event feeling signals that m has made a mistake earlier from taking on a new direction in its pattern of movement.

When a person experiences an adversity, a failure, or made a mistake, it simply means that he experiences one of the three scenarios just described: facing great resistance, being completely stopped temporarily, or taking a regretful choice. The reason why such an experience is seen as an adversity, a failure, or a mistake, is because in the reservoir of the imagination of the person, there is not record of any similar pattern. Now, if a person is able to tap deeply into his imagination, then he can take the experience to heart and find out how to avoid the same situation from happening in the future and/or how to take advantage of similar situations in the future. This end represents the priceless value of the adversity, the failure, and the mistake. Countless examples existing in the literature (Hill 1928) evidence that all successful people are those who can in one way or another use their imagination to convert adversities, failures, and mistakes, no matter how damaging they are, into assets and lessons of priceless value in their future, more successful endeavors.

12.3 The Make-Up of Conscience

By conscience, it means the ability with which one distinguishes whether his actions are right or wrong, and is deeply aware of the principles that govern his behavior and a sense of the degree to which his thoughts and actions are in harmony with the principles. When one does things not in agreement with his moral values, his conscience will make him feel remorse; when his actions confirm to his moral values, his conscience brings him feelings of rectitude or integrity. Conscience also represents the attitude which informs a person's moral judgment before performing any act.

Many authors from different angles, including religious views, secular views, and philosophical views, have studied the concept of conscience and its role in

ethical decision-making. Religious views of conscience link this concept to an inherent morality, to the universe, and/or to divinity with many nuances. Modern day scholars in fields of ethology, neuroscience, and evolutionary psychology treat conscience as a function of the brain that developed to facilitate reciprocal altruism within societies (Tinbergen 1951; Pfaff 2007; Buss 2004). It is found that conscience can prompt different people in quite different directions, depending on their beliefs. This observation suggests that while the capacity for conscience is probably genetically determined, its subject matter is probably learned, like language, as part of a culture. For example, while one person feels it's his moral duty to go to war under certain situations, while another person may very well feel a moral duty to avoid any war no matter what circumstance is concerned with. Also, numerous case studies of brain damage have shown that damage to specific areas of the brain can result in reduction or elimination of inhibitions with a corresponding radical change in behavior patterns. When the damage occurs to adults, they may still be able to perform moral reasoning; however, when the damage occurs to children, they may never develop that ability (Hare 1970). In terms of philosophical views, the word "conscience" etymologically means with knowledge. It stands for the reason that addresses questions of whether right or wrong and is accompanied with the sentiments of approbation and condemnation.

Currently, in the arena of international politics, there appeared a concept of world conscience. This concept is about the idea that with global communication possible and mostly available today we, as one people, will no longer be estranged from one another, whether it is culturally, ethnically, or geographically. Instead, we will approach the world as a place in which we all live, and with newly gained understanding of each other we will begin to make decisions based on what is beneficial for all people.

Question 12.11 Where is conscience from? Why can it help distinguish whether an action is right or wrong?

In (Lin and Forrest, to appear 1), we learned that self-awareness is one product of the constant battles between human yoyo structures. These battles make people aware of their own existence, the existence of others, be they human beings or objects. And, the strength of self-awareness is determined by the intensity of individual yoyo's spin field. In Sect. 12.2, it is concluded that the so-called imagination is in fact the totality of all the interactions between the human yoyo fields and between individual yoyo fields and the physical yoyo fields recorded either consciously or unconsciously. When one needs to utilize his imagination, he simply taps into this reservoir of records collected both consciously and unconsciously from his field interactions with others. Along with these systemic models, it can be seen that the so-called conscience is simply a partial function with two output values such that the partial function is defined on some of the spin patterns and interactions of these patterns stored in the reservoir of imagination. Here, certain kinds of field flows and interactions of the flows are assigned the value of +, known as being right or moral, and some other kinds of flows and interactions assigned the value of −, known as being wrong or immoral. The reason why this

function is only partial is because other than the flow patterns and their interactions that are assigned either a + value or a value −, there are still plentiful of other flow patterns and interactions in the reservoir of imagination that are not assigned with any + or − value. For the sake of convenience of communication, let us call this partial function the ± function. By the domain of this function, we mean the totality of all the flow patterns and the flow interactions each of which has been assigned either a + or − value.

The assignments of + and or − values of certain flow patterns and interactions of flows start when the person is still an infant and continue throughout the entire life of the person. Initially, the domain of the ± function is the empty set. As the person grows older, the domain starts to expand. And, if some dramatic event happens during his lifetime, the assignments of the + and or − values may be altered.

As suggested by the formations of the subeddies in Fig. 4.3 in (Lin and Forrest, to appear 1), some of the very first assignments of + values should be given to the flows heading in the same direction; and − values to currents flowing in opposite directions. It is because same directional flows feed into the existence of the subeddies, while opposite directional currents slow down or even attempt to stop the rotations of the subeddies. In daily language, the initial + values are given to behaviors that help strength the well-being of all children involved, and the initial − values to the behaviors that damage or destroy the well-being. For instance, when two children fight over a toy, most likely the parents would demand the children to share, reinforcing a + value on making everybody happy, even though the parents know very well which child actually owns the toy. When two little children are hitting each other, the parents would simply stop the fight forcefully, indicating the assignment of a − value to violence.

After a person reaches a certain age or level of maturity, his ± function will be quite well defined deeply in his head. So, whatever action he takes or thought he thinks of, he would unconsciously compare it to the elements in the domain of his ± function. If the action or the thought has a + value, he senses the feeling of rectitude as the consequence of being constantly appraised by adults for such occasions; if the action or thought has a − value, he feels remorse, since similar situations have been cursed regularly by grown-ups and he has let his care takers down one more time. If the action or the thought does not have a well assigned + or − value, the person will feel afraid of the potentially uncertain reactions from others. Afterward, he receives either a + or − value, or he will start his journey to explore the potential value for his specific action or thought by pushing this action further or thinking of the thought deeper until he reaches a certain outcome or he is attracted to some other more interesting, or urgent, or important topic before reaching any meaningful + or − value.

So, is one's capacity for conscience genetically determined? Our answer is an indirect YES, because our discussion on conscience indicates that conscience is completely established on imagination, which in turn is dependent on self-awareness, while self-awareness is an innate ability. On the other hand, the subject

matter of conscience, the specific content of the domain of the ± function and the assignments of the + or − values, is learned.

Question 12.12 Why is conscience deeply aware of the principles that govern one's behavior and a sense of the degree to which his thoughts and actions are in harmony with the principles?

The answer to this question lies in the discussions of Questions 4.1 in (Lin and Forrest, to appear 1), 12.7, and 12.11 above. In particular, self-awareness senses the existence of philosophical value and belief systems and that of the ± function and its domain of definition in the reservoir of imagination. When the existing value and belief systems and the ± function are combined, meaning that the elements in these systems are also assigned either + or − values, the principles that govern one's behavior are formed. So, instead of conscience, it is self-awareness that it is deeply aware of these principles and creates a sense of degree to which one's thoughts and actions are in harmony with the principles.

What is discovered so far indicates that there does not exist any inherent morality, that conscience is indeed related to the common form of motion of materials—the yoyo structure—in the universe, and that conscience can be seen as a function of the brain developed through interactions of various yoyo fields to reciprocate altruism within societies, as studied in evolutionary psychology (Tinbergen 1951; Pfaff 2007; Buss 2004). At the same time, our discussion also shows why when damages to specific areas of the brain occur to adults, they may still perform moral reasoning; and when the damages occur to children, they may never develop that ability. In particular, because conscience is a ± function with an ever-expanding domain over a person's lifetime, if the part of his brain that stores the information of the domain of the ± function is damaged, then he will either lose all the information of the domain or be unable to update the information of the expanded domain. In either case, if he is a child, whose knowledge of the ± function is nearly zero, he will never be able to gain any information on the ± function. That is why he might never be able to have the ability to perform moral reasoning.

Our conclusions here agrees with the philosophical view on conscience as with knowledge, but not on that conscience stands for the reason that addresses questions of whether right or wrong. They also explain why conscience prompts different people in quite different directions. It is because slight differences in the environment in which one grows up lead to drastic variations in the content of his philosophical value and belief systems, and how his ± function is defined in his yoyo structure. In particular, if one grows up in a family that is enemy centered, where the family's security is volatile, depending on the movements of its enemy, then it is likely that he will grow up always defining enemies and wondering what his enemies, which are those whose yoyo fields spins differently from his own, are up to and seeking self-justification and validation from the like-minded people, who are those their yoyo fields spin harmonically with his own. In this case, his judgment is narrow and distorted and he is defensive, over-reactive, and often paranoid. The power he has comes from anger, envy, resentment, and vengeance;

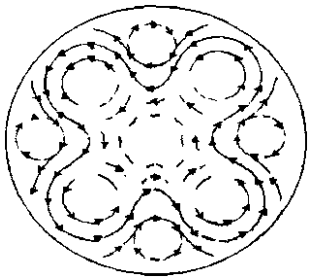

Fig. 12.5 Existence of different spin fields in one dominating pool

it is a negative energy that shrivels and destroys, leaving little energy for anything else. On the other hand, if one is born into and grows up in a family that is friend centered, where the family security is a function of the social mirror and highly dependent on the opinions of others, then it is likely that when he is fully grown, he constantly define who his friends are and makes decisions according to what his friends might think and is easily embarrassed by whatever he does. In this case, he sees the world through a self-made social lens and is limited by his social comfort zone. His actions are as fickle as opinions.

Question 12.13 Based on what is obtained above and modern scientific research, we know that for each chosen individual, his capacity for conscience is genetically determined and the specific subject contents of his conscience are learned as part of his family, the environment in which he grows up, and a culture, then how are the contents of his conscience affected by the culture?

From the discussion of Question 4.4 in (Lin and Forrest, to appear 1), it follows that the content of one's conscience is greatly affected by his family and the initial environment in which he grows up, while the family and the environment are part of a culture. So, his conscience is greatly affected by the culture. Here, by greatly affected by the culture, we do not mean that the specific contents of an individual's conscience have to coincide with the norm of the culture. Instead, as shown in Fig. 12.5 (from Fultz's dishpan experiment), along with the rotation of the dish, periodically local eddies form. Although these local whirlpools spin along with the overall dish, their individual spin directions can be completely opposite to that of the dish. This laboratory experiment in fact explains why it is possible that children grow up and live adult lives completely opposite of what they were lectured to and that in any society, no matter what the societal norm is, there are always such people who are in odds with the majority of the population. On the other hand, in the rotating dish, no matter how different a temporary local eddy might spin, it still travels along the overall direction of the dish. This implies that underneath the rich varieties of contents of individual consciences in a society, there are obvious commonalities when compared to people of other societies.

Question 12.14 Could the concept of world conscience possibly hold true and actually work so that 1 day in the future people can eventually make decisions based on what is beneficial to all people?

The answer to this question is definitely NO. It is because human societies are eddy fields formed by the natural geographical characteristics of various locations and by the distribution of natural resources (for details, refer to (Lin and Forrest, to appear 1)); and the idea of a world conscience means the appearance of a uniform flowing spin field without any local eddies existing, covering the entire globe. As evidenced by the existence of variously different patterns of airstreams from around the Earth, the idea of a world conscience can be likened to wishing all the airstreams from around the globe flow in the same direction without any local twists. It is simply impossible due to differences in temperature, humidity, pressure, and the unevenness of the surface of the Earth. As for human societies, due to differences in, for instance, the availability of natural resources from one region to another, people will have different economic interests and political desires. These and other naturally inherent differences will have to create conflicts (local eddies) between peoples. In particular, the individualism of the West and the collectivism of the East will not be entertained at the same time by any world-wide political or economic decision meaningful to all peoples' day-to-day lives.

12.4 How Free Will Works

By free will, it means the human ability to keep the promises one make to himself and others. It is the human ability to make decisions and choices and to act in accordance with those choices and decisions. The extent to which personal free will is developed is tested in day-to-day lives in the form of personal integrity. It stands for one's ability to give meaning to his words and walk the walk. It is an integral part of how much value is placed on oneself.

The concept of free will appears when people study the question of whether or not and in what sense rational agents exercise control over their actions and decisions. To address this question, one needs to understand the relationship between freedom and cause, and determine whether the laws of nature are causally deterministic. Various philosophical positions differ on whether all events are deterministic or indeterministic and on whether freedom can coexist with determinism or not—compatibilism versus incompatibilism. The existence of free will bring forward religious, ethical, and scientific implications. For example, in terms of religion, free will might imply that the omnipotent divinity does not assert its power over individual will and choices. In terms of ethics, it might imply that individuals can be held morally accountable for their actions. In terms of science, it might imply that the responses of the body and mind are not perfectly corresponding to stimuli or determined by physical causalities. The exploration on the concept of free will has been one of the central issues since the beginning of the Western philosophical thought.

In philosophy, the basic positions on free will can be categorized in terms of their answers to the following questions: 1. Does determinism hold true? 2. Does free will actually exist? By determinism, it means that all current and future events

are definitely determined by past events (Wu and Lin 2002). This point of view has been well represented by the so-called Laplace's demon, which is a hypothetical "demon" envisioned in 1814 by Pierre-Simon Laplace (Whitrow 2001; Suppes 1993) such that if it knew the precise location and momentum of every atom in the universe then it could use Newton's laws to reveal the entire course of cosmic events, past, and future. (Please consult with (Lin 2008b) for some recent studies on Newton's laws of motions and their generalizations). Compatibilism holds the point of view that the existence of free will and the truthfulness of determinism are compatible with each other; that is opposite to incompatibilism, which is the point of view that there is no way to reconcile the beliefs that in a deterministic universe there is such thing as free will (Ginet 1983).

In terms of moral responsibility, each society generally holds its people responsible for their conducts by praising or blaming for what they do individually or collectively. Therefore, many scholars believe that moral responsibility requires individual free wills of the people. This end leads to the question of whether or not individuals are ever morally responsible for their conducts; and, if so, in what sense. For more details on the studies along this line, one can refer to (Benditt 1998; Dennett 1984; Hume 1740; Greene 2004).

In the realms of science, many arguments for or against free will are based on an assumption about the truth or falsehood of determinism. Although scientific methods have historically held the promise of turning such assumptions into facts (recent studies (OuYang et al. 2002) show that either of these assumptions are completely correct so that scientific methods in this case will not be able to turn these into any fact), such facts would still need to be combined with philosophical considerations in order to amount to an argument for or against free will. For example, if compatibilism is true, the truth of determinism would have no effect on the question of the existence of free will. On the other hand, a proof of determinism in conjunction with an argument for incompatibilism would add up to an argument against free will. In particular, researches in physics, biology, neuroscience, neurology and psychiatry, psychology, and other scientific areas have touched on the concept of free will. For instance, among others, Robert Kane (1996) capitalized on the success of quantum mechanics and the wide arrange acceptance of chaos theory in his defense of incompatibilist freedom in his *The Significance of Free Will* and other writings. Many biologists were involved in one of the most heated debates in biology about that of "nature versus nurture", concerning the relative importance of genetics and biology as compared to culture and environment in human behavior (Pinel 1990). Despite of many important laboratory findings in neuroscience since the 1980s, scholars in the field did not interpret their experiments as evidence for the inefficacy of conscious free will by pointing out that although the tendency to press a button may be building up for 500 ms, the conscious will retain a right to veto that action in the last few milliseconds (Libet 2003).

Question 12.15 What is the systemic yoyo mechanism for the existence of the human endowment free will?

Based on what has been discussed, the so-called free will is the human ability to predict at least for the short term what one can or cannot accomplish and what choices are better or the best for the situation involved. In particular, with self-awareness, one forms his reservoir of imagination and his ± function of moral values with its constantly expanding domain. What matters here is where his self, as identified by his self-awareness, is located, inside the domain of the ± function or outside the domain.

If his identified self is inside the domain of his ± function with a specific value assigned to it, then the assignment of a + value to his self will force him to make as accurate predictions as possible on what he can or cannot accomplish and what choices are better or the best for the situation involved. If he were uncertain with respect to a situation, his promise either to himself or others would be that he would try his best without any guarantee for success. On the other hand, if a − value is assigned to his self, he will still force himself to make as honest predictions as possible on what he can or cannot accomplish and what choices are better or the best for the situation involved. However, in this case, most likely he will make promises opposite to what he foresees based on his imagination and his ± function. Now, when the third scenario occurs, where his identified self is not inside the domain of his ± function, then whatever appears, he would make his random promise, because no matter whether or not he keeps his promise, the outcome would not bear any conscientious consequence to him.

That is, in terms of the development of one's conscience, by placing him in an appropriate environment during his upbringing, the person's ability to keep promises can be drastically different from one kind of environment to another.

At this junction, we like to spend a little time on predictions. All the current methods of prediction developed on modern science and technology have not produced forecasts with desired degree of accuracy other than live reports. To this end, predictions of major, zero-probability natural disasters can be seen as a supporting evidence. And predictions of stock market behaviors are another piece of evidence (Wu and Lin, 2002). On the other hand, the predictions one makes about what he can or cannot accomplish and what choices are better or the best for the situation involved can be quite accurate, because these predictions are made using structural analysis on the flow patterns and interactions of different flows. In particular, any change in a structure or an interaction of structures for the foreseeable future in general is preceded by internal changes in some of the structures involved. So, when one makes prediction on what he can or cannot accomplish, he basically studies his yoyo field structure and its possible interactions with other field structures in his environment. Such structural analysis involving rotations are more accurate than any method developed in modern science, because the later possibility currently is established on linear thought, while yoyo fields are nonlinear entities. For more detailed discussion to this end, please consult with (Lin 2008b).

This discussion on free will does not imply that the omnipotent divinity from the point of view of religion does not assert its power over individual will and choices. In fact, it more specifically indicates that no matter how one is brought up,

whether he has a defined ± function with his self included in its domain or not, whether his assigned value to his self is + or −, all of which could be seen as directly under the powerful influence of the omnipotent divinity, his individual will and choices are still divinely determined by his ability to predict or how undefined his ± function is on his identified self.

In terms of ethics, our discussion implies that no matter whether or not one has a defined ± function and whether or not his self is in the domain of this ± function, he is still situated in an over-riding whirlpool, whose dominating pattern of spin dictates what specific value should be assigned to one's self. In terms of science, our discussion implies that the responses of human body and mind are not necessarily corresponding directly to stimuli or determined by external physical causalities, because the stimuli and physical causalities simply stand for environmental fields interacting with the yoyo structure of the human being; how the body and mind react to these external fields is determined by the person's prediction about what he can or cannot accomplish and what choices are better or the best for the situation involved from analyzing the patterns of flow and interactions of fields.

Question 12.16 Does rational agent actually exist? If they do, when do they experience uncertainties in their decision-making?

In areas of scientific studies, such as economics, game theory, decision theory, and artificial intelligence, anything that makes decisions, typically a person, firm, machine, or software, is referred to as a rational agent. Such an agent has a clear preference, models uncertainties via expected values, and always chooses to perform the action that results in the optimal outcome for itself from among all feasible actions. The concept of rational agents is also studied in the fields of cognitive science, ethics, and philosophy. In these studies, the action a rational agent takes depends on:

- the preference of the agent
- the agent's knowledge of its environment, which may come from past experiences
- the actions, duties, and obligations available to the agent, and
- the estimated or actual benefits and the chances of success of the actions.

From our systemic yoyo modeling, it can be seen that no human being or firm can be rational in the long term or in terms of whole evolutions, because predicting its preference well into the future and how its preference will be affected by other fields interactions will be an impossible task. To this end, current studies in behavioral economics also show that rational human agents do not generally exist (Kahneman and Thaler, 2006).

Now, assume that for short-terms, some rational human agents do exist. This would mean that these agents can perfectly predict for the immediate future what they can or cannot accomplish and what choices are better or the best for the situation involved. In this case, they may still very well experience uncertainties

when they process information due to uncertainties contained in the information. In particular, when the available information contains uncertainty, the conclusions drawn on the information will be naturally uncertain; and if the available information is perfectly correct, due to limitations of modern science and technology, the information may not be necessarily processed perfectly, leading to uncertain outcomes (Lin 1998a, b). Now, even if we assume that modern science and technology can perfectly process the correct information, due to varied expectations, different people will behave differently based on their knowledge of the perfect information, leading to an uncertain future, for more details, please consult with (Liu and Lin 2006). As a matter of fact, what we see here also indicates that rational human agents cannot practically exist for either the short term or the long term in general except for some occasional, accidental cases.

Question 12.17 Are all laws of nature causally deterministic? Is there such a thing as freedom in the reality?

In the study of blown-up theory, there is a concept known as equal quantitative effects. This concept was initially introduced by OuYang (1994) in his study of fluid motions and later, it is used to represent the fundamental and universal characteristics of all materials' movements (Lin 1998a). By equal quantitative effects, it means the eddy effects with non-uniform vortical vectorities existing naturally in systems of equal quantitative movements, due to the unevenness of materials. In this definition, by equal quantitative movements, it means such movements that quasi-equal acting and reacting objects are involved or two or more quasi-equal mutual constraints are concerned with. For example, the relative movements of several planets of approximately equal masses are considered equal quantitative movements. In the current laboratories of physics, the interaction between the particles to be measured and the equipment used to do the measurement has been often seen as an equal quantitative movement. Many events in daily lives, such as wars, politics, economics, chess games, races, plays, etc., can also be seen as examples of equal quantitative effects.

More specifically, every time when a measurement uncertainty exists, one faces the effect of equal quantities. For example, when we observe an object, our understanding of the object is really constrained by our background knowledge (because both of us and the object are spinning fields interacting with each other), our ability, and limitation of human sense organs. When an object is observed by another object (two yoyos interact on each other), the two objects cannot really be separated apart. So, such well-known theories as Bohr's principle, the relativity principle about microcosmic motions, von Neumann's Principle of Program Storage, etc., all fall into the category of equal quantitative effects.

Now, our systemic yoyo model well indicates that due to equal quantitative effects, which exist widely in the universe, at least some of the laws of nature would be neither about causalities nor deterministic. In particular, the enclosed areas in Fig. 12.6 stand for the potential places for equal quantitative effects to appear. In these areas, the combined pushing and pulling is small in absolute

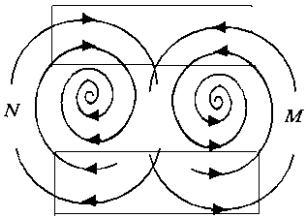

Fig. 12.6 Structural representation of equal quantitative effects

terms. However, it is generally difficult to predict what will come out of the power struggle.

Now, let us turn our attention to the second part of the question: Is there such a thing as freedom in the reality? The term freedom has many different meanings. In philosophy, it has been given numerous interpretations by philosophers and schools of thought. In general, the protection of interpersonal freedom has been an object of a social and political investigation, and the metaphysical foundation of inner freedom is a philosophical and psychological question. In terms of politics, freedom means the absence of interference with the sovereignty of an individual by the use of coercion or aggression. The idea is that members of a free society should have full dominion over their public and private lives. The opposite of a free society is a totalitarian state, which highly restricts political freedom in order to regulate almost every aspect of behavior. In this sense 'freedom' refers solely to the relation of humans to other humans, and the only infringement on it is coercion by humans (von Hayek 1991, pp. 80, 81). The right for an individual to act according to his own will is known as liberty in political philosophy. Both individualist and liberal conceptions of liberty relate to the freedom of the individual from outside compulsion or coercion. On the other hand, a socialist perspective associates liberty with equality across a broader array of societal interests, such as reasonably equitable distributions of wealth. That is, without relatively equal ownership, the subsequent concentration of power and influence into a small portion of the population inevitably results in the domination of the wealthy and the subjugation of the poor. Thus, freedom and material equality are seen as intrinsically connected. Meanwhile, the classical liberal argues that wealth cannot be evenly distributed without force being used against individuals which reduces individual liberty (Mill 2003).

Our discussion in this work indicates that in the physical reality, there does not exist such a thing as freedom in absolute terms. In particular, because each person exists along side with many other spin fields, his way of physical movement is naturally constrained and influenced by other fields. On the other hand, in one's imagination, he can in theory freely combine different patterns of movement to form what he desires. However, his potential ways of putting patterns together are still dictated by the naturally existing patterns and interactions of the patterns.

Question 12.18 Does moral responsibility require free wills of people? How are individuals morally responsible for their conducts?

As what we have seen, each society stands for a powerful over-riding spin field (a dish) (Fig. 12.5). According to the dishpan experiment, when the periphery of the dish is solid, local eddies will form periodically. While at times these local eddies might rotate vigorously in a direction not harmonic to the powerful field of the society, these local eddies, when seen as individual entities, still have to travel along with the over-riding spin direction of the "dish." Now, what is implied here is that although people have their individual free wills and a degree of mental freedom of imagining various patterns of flow and various interactions that could realistically exist, they still have to comply with the laws, which are established to protect the well-being of the society. That is, moral responsibility does require free wills of people, where by moral responsibility we mean the spin direction of the society and free wills of individual people the formation of local eddies. On the other hand, free wills of people naturally exist in any society. So, considering the orderly operation and the well-being of the society, each individual or a small group of individuals, seen as a local eddy, has to be morally responsible for that the well-being of the society is not harmed; otherwise this individual or small group of individuals will be run over by other people or elements of the society mercilessly.

In this chapter, we established on the basis of the recent development in systems science a systemic yoyo model for the human endowments—self-awareness, imagination, conscience, and free will. What is discovered is that

1. Due to constant battles existing between yoyo structures, humans become aware of their own existence, the existence of others, and their private thoughts. At the same time, they obtain a sense of individual rights and entitlements.
2. Imagination is the collection of all the conscious and unconscious records of the interactions between an underlying human yoyo field and other fields.
3. Conscience is a partial function with two output values defined on some elements of the imagination. For certain kinds of field flows and interactions, their function values are +, while for some other kinds of field flows and interactions, a − value is assigned.
4. The so-called free will is the human ability to predict at least for the short term what one can or cannot accomplish and what choices are better or the best for the situation involved. With self-awareness, one forms his reservoir of imagination and his ± function of moral values with its constantly expanding domain. Where his self, as identified by his self-awareness, is located, either inside the domain of the ± function or outside, determines how one would make and keep his promises.

That is, self-awareness is a faculty of the mind. By purposeful utilization of one's self-awareness, meaning that he purposely gets involved in various situations so that his underlying yoyo structure will be more uneven, he can continuously cultivate, develop, extend, and broaden all of his four endowments: self-awareness, imagination, conscience, and free will.

Chapter 13
Structures of Human Character and Thought

Based on what has been investigated in the previous two chapters, this chapter is devoted to the study of the systemic structure of human character, thought, desire, and enthusiasm on a unified theoretical foundation (the systemic yoyo model and its figurative analysis) in order to establish tangible results that can be potentially useful in practice. Here, both desire and enthusiasm are two extremely important driving forces behind each and every personal and professional success ever recorded in history.

By using the yoyo field models of the four human endowments—self-awareness, imagination, conscience, and free will, developed in (Lin and Forrest, to appear 1 and 2), we are able to model character and thought as specific yoyo field movements or formations. Because of these models, we are able to derive convincing results using logic reasoning. And then, we address some of the age-old problems related to desire and enthusiasm. This chapter is mainly based on (Lin and Forrest, to appear 3 and 4).

One of the several important implications of this work is that studies in social sciences and humanities can also be carried out in a similar fashion as those of natural sciences, where concepts and results are established in abstract, but real-life-like spaces, such as Euclidean spaces. In our cases here, concepts and results can be developed by using the systemic yoyo model.

The framework of reasoning established in this chapter can be employed to illustrate many seemingly unrelated social and psychological phenomena. It shows how a unified framework can play the role of theoretical foundation for all the conclusions developed by many authors, such as Plato, Aristotle, Descartes, Immanuel Kant, David Hume, and Georg Wilhelm Friedrich Hegel, to name a few, throughout the history since antiquity without reaching satisfactory conclusions. The theoretical and practical values of what follows in this chapter are implicitly contained in the presented discoveries so that a more tangible understanding of desire and enthusiasm is derived and that practically beneficial results can potentially be obtained by introducing appropriate educational programs in order

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to foster ambition, drive, desire, and enthusiasm in any person of average intelligence.

The systemic model we use to base our discussions is that each human being is a system (Chap. 11); each general system can be seen as a high-dimensional rotational field (Lin 2007; Chapters 1–3), whose realization in the three-dimensional space can be visualized as the (Chinese) yoyo (Lin and Forrest, to appear 1). That is, each human being has an underlying multi-dimensional yoyo field structure. His physical body is the realization of the multi-dimensional yoyo structure in the three-dimensional space; and his behaviors and conducts are the realizations of specific forms of motion of the yoyo structure in our familiar material world. When we look beyond our bodies into the space, the universe is indeed an ocean of yoyos of different sizes and scales, spinning in their individual directions, intensities, and orientations.

This chapter is organized as follows: in Sect. 13.1, we investigate the following questions: what is character in terms of the systemic yoyo model? Why can it be counter-productive in a different society? Is it generally true that those who possess character have enthusiasm and personality sufficient to draw to them others who have character, as claimed by Hill (1928, p. 164)? What could be the laws, existing in the human dimension that govern human effectiveness? How can such laws be potentially written in terms of the systemic yoyo model? How can breaking loose from deeply embedded, undesirable habitual tendencies, such as procrastination, impatience, criticalness, selfishness, be difficult, especially if one knows these tendencies are not good? Knowledge can be gained through learning; skills can be acquired through doing. How could one work on his desire?

Among others, we establish the following results: using self-awareness, one develops his imagination along with his upbringing. Utilizing free will, he experiments ways to interact with external systems. Whatever the consequences, the experiments and their outcomes are stored in the reservoir of his imagination. Pressured by external fields, he adopts optimal patterns for his underlying field structure to achieve the best possible balance in its interaction with specific circumstances and to deal with different yoyo structures. As the person matures over time, his ways of handling often-seen situations (external yoyo fields) are repeatedly applied, leading to the same or similar outcomes. That is, if no new-event happens, one is expected to have a relatively stable system of traits, consisting of his optimal patterns of field flow and field interactions, that specifies how he would relate and react to others, to known kinds of stimuli, and the often-seen external field structures of the environment. This relatively stable system of traits is the character of the person. Because each character is developed in a specific culture, which represents a mighty field that constantly acts on the person's underlying yoyo, the very way of rotation of his underlying field structure carries some of the characteristics of the field of the culture. That is why when the structure of a person's character developed in one society is used in a different society without modification, it may be counter-productive because the field of the new culture might spin in a direction not congruent to that of the original culture. Because a trauma one experiences stands for a severe shock to his systemic yoyo

field such that the very structure of the field can be drastically reorganized, it explains why major trauma that occurs in one's life, even in his adulthood, can sometimes have a profound effect on the character structure of the person (Brunet et al. 2007).

Personality is the subsystem of one's character that consists of all the three-dimensional realizations of his optimal patterns of field flow and field interactions that show how he related and reacted to others, to various stimuli, and to the environment. Enthusiasm is a state of intensive spin of the underlying yoyo field of one's mind and body that has a specific tilt in the axis of rotation. Comparing to self-motivation and self-determination, the intensity of spin of enthusiasm fluctuates and has a shorter lifespan. Detailed analysis implies that those who possess a certain kind of character with sufficient enthusiasm and personality will draw to them others who have the same kind of character.

In terms of the laws in the human dimension regarding effectiveness, it is shown that when two spin fields of the same scale and identical spinning intensity face off, they will eventually be locked up in an extreme hostility if no third party is involved. And, if one field is much mightier than the other, in the process of adjusting itself, the tiny yoyo will be sucked into the black hole of the mighty field.

In Sect. 13.2, we study the concept of thoughts by addressing such intriguing questions as follows: what is the systemic mechanism for thoughts to form so that they help humans model the world and to deal with what they face? Why are a person's acts always in harmony with the dominating thoughts of his mind? How could the dominating thoughts of the mind bring forward desirable outcomes according to the nature of the thoughts so that one may shape his worldly destiny according to his own liking? Why could the human mind be controlled, guided, and, directed to the desired ends? How can the systemic yoyo model be employed to explain the two creations of any material achievement—first in the mind and the second in the physical world? What is the mechanism underlying the phenomenon of mental inertia? How does human mental inertia work? Can any one who pursues after his own desired success avoid from traveling along the bloody trail created by mental inertia? The results below highlight some of what we discover in this section. Each thought is a local eddy in the reservoir of someone's imagination. Such understanding explains why new thought generally is triggered by some hint from the outside world. Each thinking process is a process of utilizing the hint to generate a local eddy in the reservoir of imagination by pulling relevant information and knowledge together to form an organic whole. Pattern matches and the well-formulated $\pm$ function of the conscience work together to form judgments about newly experienced situations. That is why to insure sound judgments being made, intellects sort through relevant knowledge and experiences against the present situation, revealing the vital importance of quality education and of the richness of the living environment. Because thoughts are simply local eddy pools in the mind and can be manipulated by mixing, matching, sifting, and sorting concepts, facts, perceptions, and experiences, they have become the most highly organized form of energy known to man. Because any bodily movement is simply a three-dimensional realization of the underlying multi-dimensional yoyo structure

of man, it explains why every voluntary movement of human body is caused, controlled, and directed by thought through the operation of the mind.

Each field flow or interaction of the outside world can play the role of a stir for someone's mind. It is because no matter how well one knows a pattern of field flows, there is always a different, new angle from which he can uncover some surprising new insights. It is shown that we do not really have absolute control over our thoughts in reality and that as long as a dominating thought is derived on accurate information, bodily realization in the three-dimensional space of the thought will become visible in no time. The formation of a local eddy in imagination is a feedback process with the initial stir being the input. Reacting to the stir, various groupings of relevant information are formed in the conscious mind and judged by using the $\pm$ function. Among all the groupings with + response values, one picks out the grouping with the most desirable + value. This feedback procedure makes people feel that they have control over their own thoughts. In this process, the original flow pattern of imagination experiences turmoil with local eddy pools formed and sense organs become keen to whatever supportive to individual groupings of information. When facing difficulties or realizing newly found resources, the chosen response will be modified. So, another feedback loop emerges. This loop creates the feeling that the human mind is guided and directed to the desired ends.

After a specific movement appears in a human field that formation can be realized in the three-dimensional space; and only after that, some tangible or visible material achievement can be possibly recognized. This sequential before and after of events explains why any material achievement has to be first accomplished in the mind and then in the physical world. At this junction, the concept of duality of yoyo fields is employed to illustrate why as long as one has a definite goal to achieve, there is always a person or people who create various difficulties for the former person along the pursuit of his goal. In terms of the relationship between individuals or a small group of individuals and their society, the "well-being" of the society stands for the maintenance of the inertia the society. The relative stability means that the underlying yoyo field of the society rotates quite vigorously without any local pool spinning in a different direction. In such a uniformly spinning fluid, any rebellious local movement will surely be crushed by the inertia of the vigorous field. The dishpan experiment indicates that for one who pursues after his desired success to avoid traveling along the bloody trail created by the inertia of the society, he has to control his field movement in conformation with the acceptable form of motion of the greater culture. As he obtains support from others and causes many others to pursue after similar goals of success, the inertia of his greater environment will be altered by his effort.

In Sect. 13.3, we focus on the study of desire, an unsettled problem considered since antiquity, by addressing questions such as: what is desire in terms of the systemic yoyo model? Why is desire so powerful in terms of dictating one's thinking and physical conduct? Where is desire from? How can we determine the depth of one's desire that makes him appear to possess supper human powers in his pursuit of life-time goals? Can desire be artificially strengthened or deepened?

Along with other interesting results, by using our systemic model, we discover that desire is how one wants his underlying yoyo structure to be in terms of one of or any combination of its attributes: direction, orientation, spin intensity, and scale. With self-awareness, he senses how his yoyo field could be potentially made uniform so that it does not have to be as it is. That is, desire comes from and is created by the differences naturally existing between human yoyo fields. With the ever expanding domain of his $\pm$ function, desirable changes are assigned with + values, making his desire vary over time. So, along with the $\pm$ function, desire motivates one to act; and in the restless movement of field rotation and interactions, desire removes the antithesis between itself and its object, and that the object of immediate desire is a living thing and forever remains an independent existence. For the relationship between desire and fear, other than they share the same brain circuit (Berridge et al. 2009), our work shows that they are really the different sides of the same coin. Desire describes what one wants for his yoyo structure, while fear how one does not want to lose what he already has within his field.

Desire also stands for a local eddy, similar to thought, in the reservoir of someone's imagination and is specifically caused by such stirs that are created from comparisons with and interactions between human field structures. That is why desire can create a thinking process to pull relevant information in the reservoir of imagination together in order to determine what is desirable and what is not. By the work of the $\pm$ function, each available stimulus is assigned a value of preference so that all available stimuli are ordered according to their desirability. As for the depth of desire, it can be measured using the intensity of the local eddy pool of the desire in the reservoir of imagination. It is derived that when the intensity of spin of the local pool reaches an extremely high level, an extraordinary amount of materials of the imagination will be pulled into the back hole of the pool, and various innovative connections are established to bridge seemingly related information and facts. When these connections are materialized in the physical world, they become valuable guidance for one to look for potentially useful resources. This sort of guidance, invisible to others, makes the specific individual appear to possess super human power in his attainment of the objective of his deeply rooted desire.

As for whether or not desire can be artificially created and strengthened, our modeling indicates that the answer is YES. In particular, the main idea is to make one's yoyo field structure uneven either by designing and employing reward systems or by creating obstacles in his life while providing him with the knowledge that when an obstacle is conquered, something magnificent will appear, or by a combined use of these two methods.

Section 13.4 focuses on the investigation of enthusiasm by looking at the following questions: what is the systemic mechanism under the intense state of mind, known as enthusiasm, that explains why enthusiasm inspires and arouses a person to put action into the task at hand and makes originally monotonous works more enjoyable to finish? What is the connection between great leaders and their own enthusiasm? How is their own enthusiasm spread over to their followers? When one is situated in a difficult situation and a long way from realizing his

definite goal in life, what is the underlying mechanism for him to be able to kindle the fire of enthusiasm in his heart and keep it burning? And why is that before very long the obstacles that now stand in the way of attaining one's definite goal will melt away, and he will find him in possession of power that he did not know he possessed? The technique with which one can fix any idea he chooses in his mind is called self-suggestion. What is the theoretical foundation for this technique of self-suggestion to work? Why is self-control so important that it can direct enthusiasm to constructive ends, to build up instead of tear down?

Among other interesting results, we derive the following conclusions. It is derived that there are two ways for a field that spins in its inertial state to suddenly acquire the momentum to rotate at a higher level of intensity: a new unevenness in the structure of the field suddenly appears, or an ever-presenting field of the environment suddenly, unexpectedly disappears. In terms of suddenly causing new structural unevenness, one can simply discover either new strengths in himself or new patterns of interaction with other fields. When the field of increased intensity is realized in the three-dimensional space, it makes people feel that his enthusiasm has inspired and aroused him to put action into the task at hand. And this realization makes the person himself feel that his enthusiasm makes originally monotonous works more enjoyable to finish. By leadership, it means one's capability to adjust his underlying field structure so that many other neighboring fields would spin in similar fashions without much difficult readjusting. With this systemic model of leadership, all the relevant studies of leadership can be unified into an organic whole. It is argued that the leader creates his high degree of spinning intensity by making use of an emerging, overreaching, and overpowering conceptual field structure. His increased field intensity is his enthusiasm, which is spread over to his followers by utilizing the field influence of the conceptual field motion, when other fields are still in their individual inertial states of motion.

If a person can keep his underlying field spin at its newly acquired momentum and intensity, the First and Third Laws on State of Motion imply that all the other field structures, which used to resist the change in the person, will have to change their forms of motion accordingly in an accommodating way. That is why before long all the obstacles that now stand in the way of attaining the person's definite goal will melt away, and he will find himself in possession of power that he can change behaviors of others according to his likings.

13.1 Character and Governing Laws for Human Effectiveness

By character, it means a person's overall, relatively permanent system of traits that are manifested in specific ways on how he relates and reacts to others, to various kinds of stimuli, and the environment (Hergenhahn 2005). Character develops over time in each individual to enable him/her to interact successfully within a given society and to help him/her to adapt to its mode of production and social norms.

When the structure of a person's character developed in one society is used in a different society without modification, it may be counter-productive.

Character is developed along with one's natural growth. For example, if a child lives in a treacherous environment and interacts with adults who do not take the long-term interests of the child to heart, then it is very likely that the child will form a pattern of behavior that helps to protect himself from harms potentially existing in the malign social environment. Also, major trauma that occurs later in one's life, even in adulthood, can sometimes have a profound effect on the character structure of the person (Brunet et al. 2007).

It is character that represents what a person is and it gives a person real and enduring power and great influence in life. One can obtain character only by building it through using his own thoughts and deeds. Those who possess character have enthusiasm and personality sufficient to draw to them others who have character (Hill 1928, p. 164). In the studies of character ethics, it is assumed that human effectiveness is governed by laws, existing in the human dimension, that are as real, as unchanging as the laws of science in the physical dimension (Covey 1989, p. 32).

Each person's character is a composite of his habits. Habits are powerful factors in any person's life. Because they are consistent and often unconscious patterns, they constantly express one's character and produce his/her effectiveness or ineffectiveness. Just as how gravity works in the physical world, habits also possess tremendous pulls. Breaking loose from deeply embedded habitual tendencies, such as procrastination, impatience, criticalness, and selfishness, which violate basic principles of human effectiveness, requires a strong willpower and a burning desire for change (Covey 1989, p. 46). The gravitational pull of habits is a powerful force. It can be utilized effectively to create the cohesiveness and order necessary for one to achieve whatever goals he/she has in life.

According to Covey (1989, p. 47), a habit is the intersection of knowledge, skill, and desire, where knowledge is the theoretical paradigm, the what to be done and the why, skill the method of how to achieve what wants to be done, and desire the motivation, the want to do. That is, to create a desirable habit, one needs to work in all these three dimensions. Because to break through to new levels of achievements from an old paradigm that has been a source of pseudo-security for years one has to work on knowledge, skill, and desire simultaneously; the drive for such a potentially labor-intensive work has to come from the call of a higher purpose. Only so, one is willing to subordinate what he thinks he wants now for what he wants later.

Question 13.1 What is character in terms of the systemic yoyo model? Why can it be counter-productive in a different society?

To successfully address this problem, let us first look at the following law:

The First Law on State of Motion (Lin 2007): *Each imaginable and existing entity in the universe is a spinning yoyo of a certain dimension. Located on the outskirt of the yoyo is a spin field. Without being affected by another yoyo structure, each particle in the said entity's yoyo structure continues its movement in its orbital state of motion.*

This law was initially introduced to address several open questions related to Newton's First Law of Motion, such as "if a force truly impresses on an object, the force must be from the outside of the object. Then, where can such a force be from"? "In their state of motion, all objects possess the so-called natural resistance to changes; then how can such a resistance be considered natural"?

For our purpose, what we need to emphasize from the First Law on State of Motion is the natural resistance to changes each system possesses. In particular, with the naturally existing self-awareness, one develops his reservoir of imagination along with his upbringing. By utilizing free will, he experiments different ways to interact with various external systems. No matter what happens, the processes and consequences of the experiments are well stored either consciously or unconsciously in the reservoir of his imagination. Pressured by external fields, such as the invisible and/or visible mandates of the culture, he adopts the optimal patterns for his underlying yoyo to rotate in order for his field structure to achieve the best possible balance in its interaction with various specific circumstances; also he develops the most efficient ways to deal with different yoyo structures. As he grows older, some of his unique ways of handling often-seen situations (external yoyo fields) are repeatedly applied, leading to the same or similar outcomes.

According to how character is defined (Hergenhahn 2005) and the systemic yoyo modelings of self-awareness, imagination, conscience, and free will in (Lin and Forrest, to appear 1–2), the First Law on State of Motion implies that if no new field structure enters one's cycle of life (his spin field), then the overall pattern of spin of his underlying yoyo structure will continue its accustomed state of motion. That is, in his ordinary life without any new-event happening, one is expected to have a relatively stable system of traits, consisting of his optimal patterns of field flow and field interactions, that specifies how he would relate and react to others, to known kinds of stimuli, and the often-seen external field structures of the environment. This relatively stable system of traits is the character of the person.

Because each person develops his character in a relatively specific culture, an over-riding spin field that constantly acts on the shape of the person's underlying yoyo, the very way of rotation of his underlying field structure carries some of the characteristics of the spin field of the culture, such as the unique rotation angle or the unique speed of spin. That explains why when the structure of a person's character developed in one society is used in a different society without modification, it may be counter-productive. For example, a school teacher, growing up in a society that emphasizes on individualism and democracy, tends to be very interested in testing various new methods of teaching and different ways to involve students. By behaving so, his unique individuality can be greatly enhanced and noted by others. On the other hand, in a different culture that focuses on collectivism, school teachers are more likely to be prudent on using any novel method of teaching because the unknown outcome may very well ruin the collective effort of producing their expected high quality students. Here, the seemingly depressed pattern of behavior is the natural result of the need for achieving group success. Now, if the former teacher ends up in the later culture, he will have a difficult time to be accepted by any reputable school system there because his interest in testing

out new ideas will be frowned upon by his colleagues and school administrators. Equally, if a teacher from the later culture teaches in the former teacher's setting, he will also suffer from various hardships due to his accustomed commitment to quality that his colleagues in the new setting do not even care about. As for which of the two school systems truly produce better quality students, it is beyond our discussion here.

Our systemic yoyo model analysis explains why character is developed along with one's natural growth; and our example shows why and how the environment in which one grows up bears the role of shaping his character. As for why major trauma that occurs in one's life, even in his adulthood, can sometimes have a profound effect on the character structure of the person (Brunet et al. 2007), it is because each major trauma stands for such a shock to the whole systemic yoyo field of the person that the fundamental hierarchy of the field might be reorganized. It means that the reservoir of the person's imagination could be reshuffled; the $\pm$ function of his conscience redefined; and the domain of his $\pm$ function reshaped.

Because the so-called character stands for the overall pattern and shape of one's underlying yoyo field structure that explains why character represents what a person is and why it is an indicator for what enduring power and influence a person has in his life over others. Because character is the totality of how a person's underlying yoyo field spins under various, ever-presenting pressures and influences of other fields with the work of his free will, it explains the reason why if one wants to build a stronger character, he can achieve the goal by using his own thoughts and deeds.

Question 13.2 Is it generally true that those who possess character have enthusiasm and personality sufficient to draw to them others who have character, as claimed by (Hill 1928, p. 164)?

Based on the systemic yoyo model of character, established in the discussion of Question 13.1 above, we now know that by character, it means the relatively stable system of traits, consisting of one's optimal patterns of field flow and field interactions, that specifies how he would relate and react to others, to various known stimuli, and often-seen external field structures of the environment. In order to address Question 13.2 with a degree of satisfaction, we need to first understand the concepts of enthusiasm and personality. By enthusiasm, it signifies a wholehearted devotion to an ideal, cause, study or pursuit, or merely being visibly excited about what one's doing (Tucker 1972). It stands for intense enjoyment, interest, and/or approval. And, by personality, it means one's aggregate conglomeration of decisions he has made throughout his life. There are inherent natural, genetic, and environmental factors that contribute to the development of one's personality (Allen 2005).

So, based on the systemic yoyo model of character, the so-called personality is the subsystem of one's character that consists of all the three-dimensional realizations of his optimal patterns of field flow and field interactions that show how he related and reacted to others, to various stimuli, and to the environment. And, by using the systemic yoyo model, enthusiasm can be visualized as a state of intensive spin of the underlying yoyo field of one's mind and body that has a specific tilt in

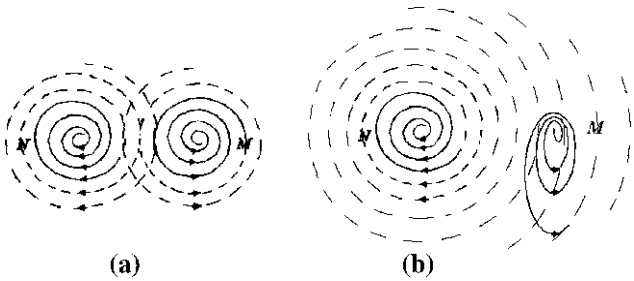

Fig. 13.1 Imaginary acting force of an enthusiast *N* over *M*

the axis of rotation. Here, the special tilt in the axis of rotation is emphasized to represent the person's specific whole-hearted devotion. When compared to the systemic modeling of self-motivation and self-determination, as discussed in Question 13.1.5 in (Lin and Forrest, to appear 1–2), enthusiasm is the same as that model except that its state of intensive spin of the underlying yoyo field of the mind and body does not last as long as that of self-motivation and self-determination and that throughout the lifespan of enthusiasm, the intensity of spin of the underlying yoyo field might change from strong to weak and vice versa alternatively.

This model of enthusiasm provides a detailed explanation for why enthusiasm is contagious to all with whom the enthusiast comes in contact (Hill 1928, p. 153). In particular, assume that there are two people *N* and *M*. Initially, none of them is specifically enthusiastic about anything in particular. That is, their underlying yoyo fields are loosely acting on each other, Fig. 13.1a, where the fields of *N* and *M* overlap so that they act on each other without forcing each other to change their respective shapes. Now, for whatever reason, *N* becomes visibly enthusiastic over what he is doing so that its field suddenly spins at a much higher level of intensity so that the field of *M* is greatly affected. As shown in Fig. 13.1b, the originally circular spin field of *M* now becomes oval, where the left-hand side is helped by the field of *N* to travel faster and further than before, and the right-hand side faces much greater resistance than before from the field of *N* that is newly strengthened.

This analysis indicates that what Hill claims is not completely correct. Specifically, as shown in Fig. 13.1, if the yoyo fields of persons *N* and *M* spin in opposite directions, when one suddenly experiences a surge in its intensity of spin, the other person in fact suffers from the consequence. For instance, *M*'s territory is altered against his will because now he is forced to move along a new, elliptical orbit; while he is pressured to behave in certain ways in order to conform with the increased intensity of *N* (the left-hand side of *M*), he can no longer do whatever he likes to do as before without first fighting to obtain *N*'s approval (the right-hand side of *M*). On the other hand, if the yoyo fields of *N* and *M* are both convergent and spin harmonically, meaning that they spin in the same direction (Fig. 13.2), then their original, naturally existing attraction will be greatly strengthened by the sudden increase in the field intensity of *N*. This is exactly what Hill describes: enthusiasm is

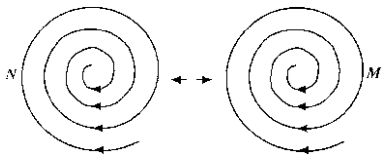

Fig. 13.2 The fields of N and M spin harmonically and convergently

contagious to all with whom the enthusiast comes in contact, if we assume that by "all with whom the enthusiast comes in contact," he means those who are also willing to associate with the enthusiast. By carefully analyzing different ways two yoyo fields could possibly interact with each other, it can be easily seen that the two scenarios we mentioned here are only two special cases of many possibilities. This end in fact explains why no matter what one is enthusiastic about, other than those who are genuinely supportive of him, there are countless many others who hold varied and quite opposite opinions about his newly found excitement.

So, from the previous analysis, we can conclude that what Hill (1928, p. 164) claims, as questioned above, is about the specific kinds of characters that would bring one what he desires in life and that would create him the needed or desired beneficial influence over others. At the same time, as pointed out earlier, if the yoyo fields of people who possess the kinds of characters as Hill describes spin in different directions, they will never be able to attract each other. That is, we can modify what Hill says as follows: Those who possess a certain kind of character with sufficient enthusiasm and personality will draw to them others who have the same kind of character.

Question 13.3 What could be laws existing in the human dimension that govern human effectiveness? How can such laws be potentially written in terms of the systemic yoyo model?

To address this question, we first need to clarify the meaning of the word "effectiveness." According to the Webster's Seventh New Collegiate Dictionary (1971), this word means producing a decided, decisive, or desired effect, with emphasis placed on the actual production of the effect when in use or in force. By using the yoyo model, this word specifically stands for one's capability to make other fields to flow in directions and ways he desires. In particular, if person *N* can make *M* spin at a desired orientation (or the tilt of *M*'s axis of rotation), intensity, speed, and direction (Fig. 13.1), then *N* is said to have an effect on *M*.

Based on the systemic yoyo structure underlying each and every human being, it can be naturally seen that any law existing in the human dimension that bears a degree of governing power over human effectiveness should be about special characteristics of a spin field and its interactions with other eddy fields of humans. To this end, let us first look at the simplest case with only two people, named X and Y, who live side by side in isolation from others. The reason in general why two people can live together is because they possess similar and complementing personalities and characters (Hendrix 2001). To accommodate this requirement, let us assume without loss of generality that the yoyo fields of X and Y satisfy the following:

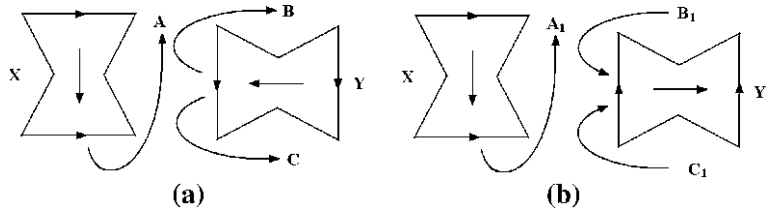

Fig. 13.3 The tendency for yoyos to line up along their axes of rotation

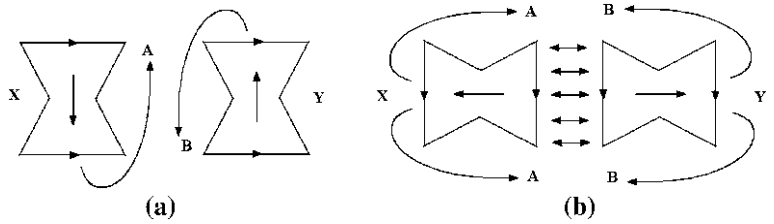

Fig. 13.4 Realignment of X and Y making their meridian fields flow in the same direction

Left-Hand Rule 1: When holding our left hand, the four fingers represents the spinning direction of the eddy plane and the thumb points to the direction along which the yoyo structure sucks in and spits out materials along its axis of rotation (the narrow neck).

Now, let us see why yoyo structures of X and Y have the tendency to line up side by side with their axes of spin parallel to each other. As a matter of fact, if the yoyos X and Y are positioned as in Fig. 13.3a, then the meridian field A of X fights against C of Y so that both X and Y have the tendency to realign themselves in order to reduce the conflicts along the meridian directions. Similarly in Fig. 13.3b, the meridian field A_1 of yoyo X fights against B_1 of Y. So, the yoyos X and Y also have the tendency to realign themselves as in the previous case.

Assume that after some compromise, X and Y do line up from their initial position in Fig. 13.3a with their axes of rotation parallel to each other except that their meridian fields flow in opposite directions (Fig. 13.4a), then X and Y will further realign so that their meridian fields will be facing the opposite directions (Fig. 13.4b). After reaching the situation in Fig. 13.4b, there is not much X and Y can do to reach further compromise without interference from outside of their two-men system.

If from their initial position in Fig. 13.3b, X and Y line up with their axes of rotation parallel to each other and their meridian fields flowing in the same direction (Fig. 13.5), then the black-hole sides tend to attract each other and the big-bang sides repel each other. So, the yoyos X and Y also tend to realign to a situation like the one in Fig. 13.4b. However, what is different of the situation in Fig. 13.4a is that in this case, the attraction and repulsion in the enclosed areas in

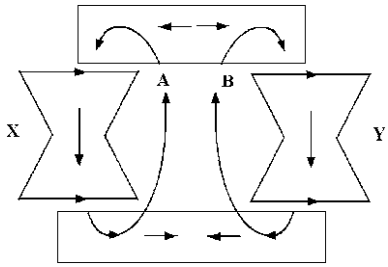

Fig. 13.5 X and Y reaches a complete compromise

Fig. 13.5 are much weaker than the intensity of fight against each other between X and Y in Fig. 13.4a. That is, the alignment of X and Y in Fig. 13.5 represents the most stable positioning of these fields in terms of their interactions.

Now, consider two random people of similar social status who are thrown together by some external force, such as sharing a dormitory room in a university setting or an office in an employment environment, or assigned to work on a project. Similar to what is just analyzed, the yoyo fields of these two people also have the tendency to realign themselves so that their axes of rotation would be parallel to each other. So, the interaction between their eddy fields can take any of the scenarios in Fig. 13.6.

By looking over the possibilities of interaction between yoyo fields *N* and *M* in Fig. 13.6, we can see the following:

1. In scenarios (a) and (e), *M* attracts *N* because *N* is divergent and *M* convergent. In these cases, *M* and *N* will never combine into one greater field.
2. In scenarios (d) and (h), *N* attracts *M* because *N* is convergent and *M* divergent. So, *M* and *N* will never combine into one mightier yoyo.
3. In scenarios (b) and (f), *N* and *M* repel each other, where both *N* and *M* are divergent; and
4. In scenarios (c) and (g), *N* and *M* attract each other. In particular, in (c) *N* and *M* have a tendency to combine, while in (g), because the rotational directions of *N* and *M* are opposite of each other, they tend to combine and destroy each other.

Because the interaction between *N* and *M* in scenario Fig. 13.6c has the tendency of combining the two spin fields, let us look at the other side of these two fields. The interaction of the opposite sides of N and M is depicted in Fig. 13.6b, where *N* and *M* repel each other. So, the dynamics between *N* and *M* in scenario Fig. 13.6c can be described as follows: as *N* and *M* travel toward each other in their attempt to combine into a greater field, their closer distance makes the diverging fields of *N* and *M*, as shown in Fig. 13.6b, start to repel against each other. The force of repellence comes from the opposite spinning directions of the fields of *N* and *M*. Under the influence of this force, *N* and *M* are pushed away from each other. When *N* and *M* travel away from each other to a certain distance, the attractions of the other sides of *N* and *M* (Fig. 13.6c) start to once again pull

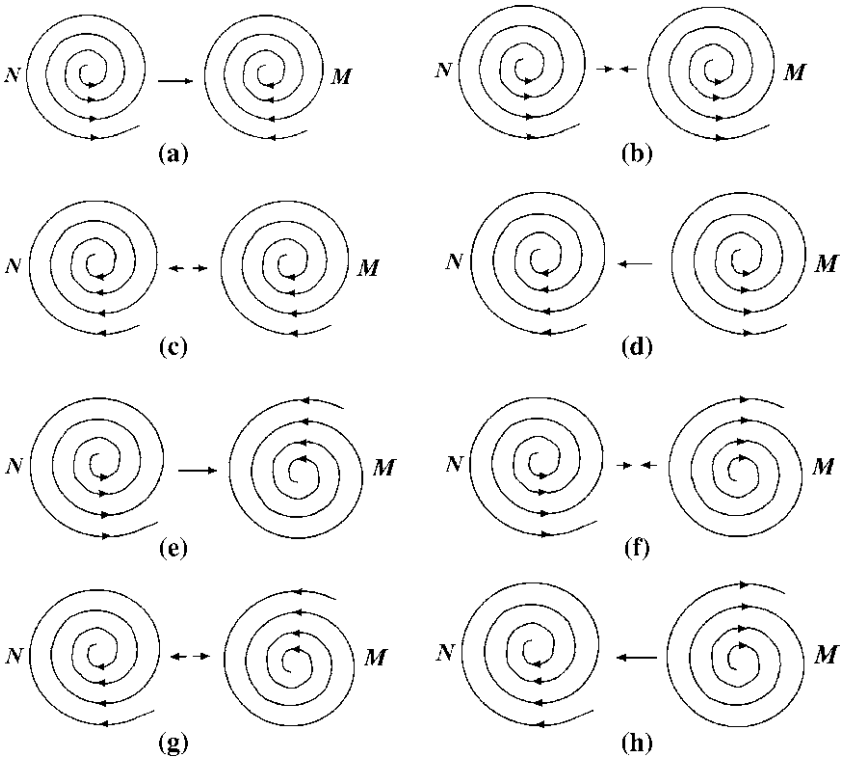

Fig. 13.6 Interactions between two same-scale spinning yoyos. **a** *N* diverges and *M* converges. **b** Both *N* and *M* diverge. **c** Both *N* and *M* converge. **d** *N* converges and *M* diverges. **e** *N* diverges and *M* converges. **f** *N* converges and *M* diverges. **g** Both *N* and *M* converge. **h** *N* converges and *M* diverges

them together. Such alternating effect of repulsion and attraction keeps *N* and *M* together and on their individual terms.

As of now, all these analyses on two human yoyos hold true only with the assumption that X and Y (or *N* and *M*) represent same scale fields with identical intensities of rotation. And, if any one of them is weaker than the other, the situation will be different. To this end, let us look at the interaction between one mighty yoyo field M and a tiny particle field m in Fig. 13.7. First, as analyzed above, the particle yoyo m has to line up its axis of rotation with and parallel to that of M; and secondly, m is forced to line up with the mighty M in such a way that the axis of spin of the tiny m is parallel to that of M and that the polarities of m and M face the same direction. For example, Fig. 13.7 shows how particle yoyo m has to rotate and reposition itself under the powerful influence of the meridian field of the much mightier and larger yoyo structure M. In particular, if the two yoyos M and m are positioned as in Fig. 13.7a, then the meridian field A of M fights against C of m so that m is forced to realign itself by rotating clockwise in order to

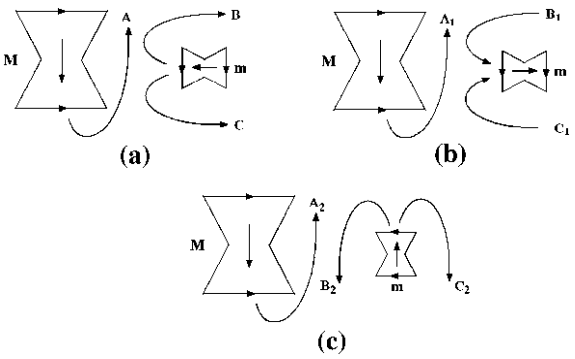

Fig. 13.7 How mighty spinning yoyo M bullies particle yoyo m

reduce the conflicts with the meridian direction A of M. If the yoyos M and m are positioned as in Fig. 13.7b, the meridian field A_1 of yoyo M fights against B_1 of m so that the particle yoyo m is inclined to readjust itself by rotating once again clockwise. If the yoyos M and m are positioned as in Fig. 13.7c, then the meridian field A_2 of yoyo M fights against B_2 of m so that the tiny particle yoyo m has no choice but to reorient itself clockwise to the position as in Fig. 13.7b. As what has been just analyzed, in this case, yoyo m will further be rotated until its axis of spin is parallel to that of M and its polarities face the same directions as M. Also, in the process when the tiny yoyo m adjusts itself with respect to the might M, the powerful meridian field A would have carried m to the entrance of its black-hole side.

This end describes how realistically those who possess a certain character and have sufficient enthusiasm and personality can draw to them others who have the same kind of character (but weaker enthusiasm and personality), as claimed by (Hill 1928, p. 164). This last statement can surely be seen as a law, written in terms of the systemic yoyo model, in the human dimension that governs at least some aspect of human effectiveness.

What we have done so far in addressing Question 13.3 only dealt with the interactions between two yoyo fields. When more fields are involved, we will have to consider situations of three-, four-, or n-body problems, for any natural number $n > 2$. These problems have been extremely difficult and unsettled since the dawn of modern science over 300 years ago. For more details, see (Lin 2007) and references there.

Question 13.4 How can breaking loose from deeply embedded, undesirable habitual tendencies, such as procrastination, impatience, criticalness, selfishness, and be difficult, especially if one knows these tendencies are not good?

Based on what we have obtained earlier, each habit comes from consistent and unconscious repetition of a field flow pattern in one's underlying yoyo structure in his dealing with the spin fields of other human beings, situations, or objects. It belongs to his relatively stable system of traits, known as his character. Because over time each trait in the system has been tested, confirmed, and reconfirmed with various relevant, but different field flow patterns, it has been set in an inertial state

of motion, as what is described in the First Law on State of Motion (Lin 2007). So, when one knows that one of his habits is not good, meaning that he recently encountered a new pattern of field flow, leading to his realization of the deficiency of that specific habit, he sees the need to change or modify the habit (the pattern of flow). However, comparing to how well the flow pattern (the deficient habit) has worked over time, this newly acquired need for change in general is not very strong because the recently encountered pattern has not appeared enough times. In other words, to truly make the needed change in the deficient habit, a new yoyo field has to present steadily and powerfully in order to provide a constant and influential appearance of the newly experienced pattern of flow, as suggested by the First Law on State of Motion. This end explains why in general it is difficult to break loose an undesirable habit without a powerful and steady interference of a new yoyo field.

Question 13.5 Knowledge can be gained through learning; skills can be acquired through doing. How could one work on his desire?

Similar to self-motivation and self-determination, as discussed in (Lin and Forrest, to appear 1–2), for one to work on his desire, meaning that he works on making his underlying yoyo structure spin more on its own for at least a period of time, he has to, in theory, make his yoyo field not as even or uniform as before. It is because the newly created internal unevenness will naturally produce gradients, which in turn lead to moments of force so that the yoyo field will naturally rotate on its own. In particular, to create the necessary unevenness, one has to experience hardships and/or learn the existence of better possibilities. Because of this reason, it can be concluded that in general desires can be more naturally created by external forces than by reasons from within. So, one way to address the question of how one can work on his desire is to constantly compare his own state of affairs with those who are more successful.

13.2 Thought: Its Formation and Consequences

Thoughts (and thinking) are mental forms and processes. They are the most highly organized form of energy known to man. Thinking allows humans to model the world and to deal with what they face according to their objectives, plans, and desires. And, every voluntary movement of the human body is caused, controlled, and directed by thought through the operation of the mind. The presence of any thought or idea in one's consciousness tends to produce an associated feeling and to urge him to transform that feeling into appropriate muscular action that is in perfect harmony in the nature of the thought.

The concept of thoughts is similar to that of imagination. Each thinking process involves mental manipulations of what is observed or received through the sense organs, as when abstract concepts are formed, problems are resolved, and decisions are made (Baum 2004). The human brain makes pattern matching; in each moment of reflection, new situations and new experiences are judged against those

learned or experienced from the past and judgments are then formed. To insure sound judgments are being made, the intellect sorts through all relevant knowledge and past experiences against the present situation, while keeping the present situation distinct and separate from the past experiences. Here, the outstanding knowledge is generally forced upon him or acquired through his own volition under highly emotional conditions when his mind was most receptive. The three great, organized forces of passing on knowledge are: schools, press, and the church (Hill 1928, p. 321).

With practice and adequate training, the intellect can readily mix, match, sift, and sort concepts, facts, perceptions, and experiences. This mental activity and process is known as reasoning. The self-awareness of this mental process of reasoning is referred to as an access to one's own consciousness (Block 2007).

Thought is one thing over which one has absolute control; he has the power to select the material that constitutes the dominating thoughts of his mind. And, the dominating thoughts of the mind bring forward desirable outcomes according to the nature of the thoughts. That is, thought can be employed as an important tool, with which one may shape his worldly destiny according to his own liking. To this end, the so-called self-control is solely a matter of thought control. When one deliberately chooses his thoughts to dominate his mind and firmly ignores all outside suggestions, he exercises self-control in its highest and most efficient form (Hill 1928, pp. 183–184).

To achieve a definite purpose or goal in life, Napoleon Hill (1928, p. 245) suggested sowing the seed of the purpose in the subconscious mind, thinking accurately, and then utilizing creative thought of a positive, non-destructive nature, without hatred, envy, selfishness, and greed, to awaken the seed into growth and maturity. The reason why one has to think accurately in order to materialize his definite purpose in life is because the mind can be controlled, guided, and, directed to either creative and constructive ends or destructive ends. For instance, all the greatest of all achievements, whether in the literature, art, finance, industry, commerce, transportation, religion, politics, or science are usually the results of thoughts formulated in someone's mind, and then transformed into reality by his followers through the combined use of their collective minds and bodies (Hill 1928, p. 248).

Because any achievement in the material world is always first created in the conscious mind through imagination as a thought and then transformed into the tangible physical reality through the subconscious mind, it suggests on how concentration actually works and explains why the first step in achieving any goal in life is to create a definite mental picture for what is desired, then followed by concentrating on that picture until the subconscious mind translates it into the ultimate and desired form (Hill 1928, p. 250).

Also, along the road of achieving success of any kind, one always needs to be aware of the widely existing phenomenon of mental inertia of human societies, even though almost every significant breakthrough in the field of scientific endeavor is first a break with tradition, with old ways of thinking, and with old paradigms (Kuhn 1996). Because of this common but tragic mental inertia, Socrates sipped the hemlock, Stephen was stoned, Bruno was burned at the stake,

and Galileo was terrified into retraction of his starry truths. Forever would one desiring magnificent success in the physical world almost surely travel down that bloody trail in different degrees through the pages of history.

Question 13.6 What is the systemic mechanism for thoughts to form so that they help humans model the world and to deal with what they face?

A thought is simply a local eddy in the pool of available knowledge that has been recorded either consciously (through sense organs) or unconsciously (not through any sense organ) in the reservoir of imagination. Thoughts are not imagination, but local spin fields in the big pool of various available patterns of flow and interactions of flows readily available in the reservoir of imagination. This systemic modeling of thoughts explains why a new thought in general germinates in the mind as triggered by some kind of hint collected from the outside world. The hint could be a new understanding of a well-understood pattern or interaction, or a realization of a new combination of several relevant patterns or interactions, or a newly emerging pattern or interaction that has been unconsciously available before in the reservoir of imagination.

Each so-called thinking process (Baum 2004) is a process of utilizing the hint from the outside world to generate a local eddy in the reservoir of imagination by pulling relevant information and knowledge together to form an organic whole. The working mechanism here is similar to the situation of a relatively calm pond of water that is suddenly interrupted by an object falling into the pond. The impact of the object creates waves propagating through the entire pond by mobilizing each water particle. Whichever "water" particle is useful and relevant, its essential meaning will be gathered to form a local eddy current in the reservoir of imagination in order to form a good pattern match. Pattern matches and the well-formulated $\pm$ function of the conscience work together to form judgments about newly experienced situations and experiences.

Because the definition of the $\pm$ function is formed and enriched throughout one's entire lifetime, when a new situation or experience does not match any element in the domain of the $\pm$ function perfectly, if the situation or experience is crucial to the well-being of the person, he will be forced to employ thinking process to decide what value, either + or -, should be assigned to the situation or experience at hand. This process of value-assignment generally takes some time for mental manipulation for a quite while for relevant currently unknown facts to fall in places. This end explains why to insure sound judgments being made, intellects, those with solid education backgrounds, sort through all relevant knowledge and past experiences against the present situation, while keeping the present situation distinct and separate from the past experiences. It also explains the vital importance of quality education and that of the richness of the living environment in which one grows up. Our analysis entails the fact that by quality education, it means that other than forcing the fundamental information necessary for one to function effectively and efficiently in the society and skills on how to learn what is not taught to him on his own, it is more about how to form needed eddy pools to resolve problems that have never been seen before and to meet

challenges. By the richness of living environments, it means such an environment that is filled with different activities and experiences that make one's yoyo pool uneven so that more or less the person will be self-propelled to achieve. As what we have studied earlier, structural unevenness is the reason for any yoyo structure to spin due to reasons from within.

Because thoughts are local eddy pools in the mind and can be manipulated by mixing, matching, sifting, and sorting concepts, facts, perceptions, and experiences, they have become the most highly organized form of energy known to man. This is especially true in our modern time with advanced technology and has been manifested time and again by the designs and manufactures of some of the most amazing products man has ever imagined, such as steam engines, airplanes, computers, etc.

As for why every voluntary movement of the human body is caused, controlled, and directed by thought through the operation of the mind is because any bodily movement is simply a three-dimensional realization of the underlying multi-dimensional yoyo structure of man. Just as in the case where the first existence of materials and then followed by the appearance of time, which is simply a sign of eddy motion of materials, is argued (Wu and Lin 2002), in this case, the existence of materials, the formation of local eddy currents, precedes the actual rotation of the materials. And only after materials start to rotate, the rotating materials can be possibly actualized in the three-dimensional space for our sense organs to pick up.

Question 13.7 Why are a person's acts always in harmony with the dominating thoughts of his mind?

The discussion of Question 13.6 in fact has answered this question. As a matter of fact, one's acts, which are realizations of some eddy currents in his multi-dimensional field structure, take place after his relevant thoughts (the eddy currents) have been formulated. The reason why the eddy currents were formulated in the first place inside his reservoir of imagination is because he has gone through some mental manipulations, which requires consumption of energy, concentration, gathering of information, and making matches and adjustments. This explains why only dominating thoughts in general produce tangible bodily acts in the three-dimensional space.

Question 13.8 How could the dominating thoughts of the mind bring forward desirable outcomes according to the nature of the thoughts so that one may shape his worldly destiny according to his own liking?

Each thought, as just discussed, is a local eddy pool in the reservoir of imagination, caused by a stir from an outside source. And, pretty much any field flow or interaction from the outside world one can focus on and make it a stir in his mind. In particular, if a flow or interaction has never registered in his reservoir of imagination, then he can surely ponder over the new phenomenon and see what new information or knowledge he could potentially extract and how personally he can benefit from this new discovery. If the flow or interaction is a simple repetition of what is well known, then he can use his imagination to look at it from a new angle for the purpose of creating a new twist to it. This mental manipulation is similar to looking at the familiar natural surrounding through various lenses of

different colors. What might be surprising here is that when our eyes are covered with a lens of certain color, although the overall arrangement and layout of the surrounding looks the same, some of the previously invisible patterns may appear and become obvious. In terms of mental lenses, they are known as paradigms. As is well argued by Covey (1989), how facts are seen depends on in which paradigm one lives. Same facts can be interpreted very differently or even in contradictory ways. This fact of life alone indicates that no matter how well one knows a pattern or interaction of field flows, there is always a different, new angle from which he can uncover some surprising new lights about the known pattern or interaction.

As for whether or not one has absolute control over his thoughts, our systemic yoyo modeling suggests that it be not exactly so. It is because first of all, it is true that one has the power to select the material that constitutes a specific thought of his mind. However, to make the thought real-life relevant and realizable in the three-dimensional space, the thought has to be accurate, derived on materializable field patterns or interactions, and developed on the currently available technology. For instance, let us imagine that we liked a remote area in a third-world country; the specific location was touched by neither modern industry nor currently advanced commerce. Based on what we knew about health and healthy living, we imagined our quality life in this godly environment, where the air was not even slightly polluted, water still tasted pure and sweet, and all the food naturally grown. So, in this place we could live our lives in complete harmony with nature. However, after our initial wave of excitement, generated from actually living in the said place, was over, we had to face the day-to-day details of living. Very soon, we would withdraw from this special place and retreat back to our accustomed environment of comfort. This imaginary scenario has been played out in real-life by many. That is, the absolute control of thoughts does exist in theory. However, in reality, it does not hold up.

As for why dominating thoughts of the mind can bring forward desirable outcomes according to the nature of the thoughts, it is because when a thought in someone's mind becomes dominating, he would have spent a lot of his time and energy on making it exciting and potentially materializable in our three-dimensional space. As what we just studied about the systemic structure of thought, as soon as a stir appears to a person's self-awareness, the entire reservoir of his imagination is affected so that relevant information is gathered and related $\pm$ values assessed. The fact that each human being is a multi-dimensional spinning field implies that as long as the dominating thought is derived on accurate information, bodily realization in the three-dimensional space of the thought will become visible in no time.

That is, to anyone, who is self-determined, meaning that his underlying yoyo spins on its own without any or much interference from the outside world, thinking is an important, must-have tool and thinking process the inevitable path for him to travel through in order to materialize a worldly destiny according to his own liking, which fits his unique way of spin.

This analysis well demonstrates why the so-called self-control is solely a matter of thought control; and when one deliberately chooses his thoughts based on accurate

and realizable information to dominate his mind and firmly ignores all outside suggestions that are not congruent with his thoughts, he exercises self-control in its highest and most efficient form, as claimed by Napoleon Hill (1928, p.184).

Question 13.9 Why could the human mind be controlled, guided, and, directed to the desired ends?

The mind can be seen as fundamentally made up of the four human endowments: self-awareness, imagination, conscience, and free will. As discussed above, when a stir appears through the faculty of self-awareness, one takes in the new information and mobilizes his entire reservoir of imagination to formulate a response by making use of his conscience (the $\pm$ function) and free will (the ability to make at least short-term predictions). That is, the actual formation of a local eddy in his imagination is really a feedback process, in which the initial stir is the input. To respond to the stir, various groupings of relevant information and knowledge are formed in the conscious mind. These groupings of known data are judged by using the $\pm$ function. When a value is seen assigned to the response produced out of a specific grouping, the relevant combination of information and knowledge is disregarded. When a response does not have a definite $\pm$ value, more relevant data out of his reservoir of imagination are pulled into the specific grouping until a definite $\pm$ value can be possibly assigned. Among all the groupings with + response values, the person orders the response values according to his preference or the instantaneous need or liking of the moment so that he could handily pick out the one response with the most desirable + value. This feedback procedure makes people feel that they have control over their own thoughts. For a general treatment of feedback systems, please consult with (Lin and Ma 1990).

Now, with the mind fully activated toward formulating a desirable response or outcome, the originally relatively stable flow of the reservoir of imagination begins to experience turmoil and various local eddy pools start to form. Accordingly, the sense organs become keen to whatever in the surroundings that is supportive to individual groupings of information and knowledge. Along with the alert and excited sense organs, the entire underlying multi-dimensional yoyo structure of the person starts to act in various harmonic ways correspondingly. So, this purposeful movement, which might well be unconscious to the person, of the underlying structure is eventually actualized in the three-dimensional space. When facing difficulties or realizing newly found resources in this three-dimensional physical space, the originally chosen response will be voluntarily modified either to overcome the difficulty or to take advantage of the newly found resource. Once again, a feedback loop emerges. This feedback loop creates the feeling that the human mind is guided and directed to the desired ends.

This systemic explanation developed to address Question 13.9 in fact illustrates that if one has a definite purpose or goal in life, in one way or another, he has been terribly stirred or troubled when his established world view and belief system was somehow turned upside down at least partially. Through the feedback mechanism, he is able to form his most desirable outcome in his conscious mind by making use of his self-awareness, imagination, the $\pm$ function of his conscience, and his ability

of making predictions. If for whatever reason, the stir is truly severe, then he will naturally have a burning desire to materialize his imagined outcome in the physical world in order to even out the imbalance created by the stir in his reservoir of imagination and the associated $\pm$ function of his conscience. By making use of what we just obtained in the previous paragraph, in order to bring about bodily actions toward materializing the burning desire, one should concentrate on the chosen outcome, think accurately about all relevant information, knowledge, and available resources. Here, for one to achieve true concentration, he has to avoid wasting his energy, especially his mind power, on seemingly related, but in reality not necessary needs, such as hatred, envy, selfishness, and greed. Each of these unnecessary needs can easily consume all the available time, energy, and resources needed to meaningfully realize any noble goal in life.

Question 13.10 How can the systemic yoyo model be employed to explain the two creations of any material achievement—first in the mind and the second in the physical world?

The answer to this question comes from the general fact that materials, be they tangible or intangible, exist prior to any form of movement of the materials (Lin 1998b). Speaking more specifically, before a particular aspect of a human yoyo field can be realized in our three-dimensional space, the relevant field has to first experience some sort of formation or movement. And only after a special aspect of the multi-dimensional field is realized in the three-dimensional space, some tangible or visible material achievement can be possibly recognized. This sequential before and after of events provides the reason why any material achievement has to be first accomplished in the mind and then in the physical world.

At this junction, it is necessary to note that due to the duality of yoyo fields (Lin 1998b), meaning that yoyo fields exist in pairs, each of which contains two fields spinning in directions opposite of each other, when one forms an idea or a definite goal to reach with a burning desire, there will naturally be an opposite idea or definite goal out there in the immediate surroundings for someone else or people to accomplish. This later person or people in real-life generally create various degrees of difficulties or hardships for the former person along his pursuit of his goal.

Assume that person A has a burning desire to reach a definite goal. To successfully materialize his dream, he will have to put in some kind of hard work into his pursuit. For instance, person A desires to possess a lot of wealth through conventional means, hard work combined with intelligence, and without hurting anyone else. If he is lucky enough to eventually materialize his goal, then he will generally experience through the following stages of struggle.

1. In the beginning stage of forming his own very goal, many people within his immediate surroundings will discredit his idea by saying directly to him such things as “money is not everything in life,” even though A never says and believes that money is everything.
2. As the goal begins to crystallize in A’s mind, more people will start to discredit this idea by providing him similar reasons as “money is not everything in life.”

At the same time, these people will try to convince each other that A is about to make a terrible mistake in his life.
3. When A begins to carry out his plan of acquiring a lot of money, these same people plus additional more will communicate with A and among themselves that A is crazy and will never make it because his plan is flawed.
4. As A starts to bring about initial signs of success, these people will begin to circulate various untrue stories of A just to calumniate on A's character.
5. As A enjoys his eventual success of owning of a lot of wealth, some of the other people would also have achieved what they unconsciously wanted: the service A provides, fame, and some monetary awards, from trying to destroy A.

Now, let us see why these stages 1–5 generally play out as outlined. At stage 1, for whatever reason, person A's reservoir of imagination is stirred so that some special local eddy begins to form. That is, his underlying yoyo field starts to move differently from before. Along with this subtle change, all the yoyo fields in A's immediate surroundings begin to feel the pressure. As their natural resistance to the pressure, the existence of such resistance is guaranteed by the First Law on State of Motion, they fight back toward A. As A moves forward to crystallize his plan, his yoyo field inevitably places more pressure on the other yoyo fields, creating more intensive resistance from these fields. When A starts to carry out his plan, his crystallized goal is realized and becomes visible in the three-dimensional world. This realization provides a tangible target for the other people to react to. As A's field actually sucks in wealth by providing what other people need in their lives, these people found more materials to give out from their fields: making and telling untrue stories about A. As A eventually reaches the great success as he envisioned from the very start, the high level of intensity of his spinning field structure inevitably has also helped several other fields to rotate at high intensities.

What is interesting here is that the word "wealth" can be replaced by almost any other word, and similar stages of struggle play out just the same.

Question 13.11 What is the mechanism underlying the phenomenon of mental inertia? How does human mental inertia work? Can any one who pursues after his own desired success avoid from traveling along the bloody trail created by mental inertia?

The first two parts of this question have been addressed in the discussions of the previous questions. As for the third part, let us look into our systemic model in more details to see whether or not there is such a possibility that one yoyo can increase its intensity of spin without being drowned or totally wept out by others. To do this end, let us look at some of the representative examples from the past.

Historically, the reason why Socrates, a classical Greek philosopher who is credited as one of the founders of Western philosophy, sipped the hemlock is because his pursuit of virtue and strict adherence to truth clashed with the then-current course of Athenian politics and society (Brun 1978). He lived during the time of the transition from the height of the Athenian hegemony to its decline with the defeat by Sparta and its allies in the Peloponnesian War. However, Socrates praised Sparta in various dialogues. And, his offense to the city of Athens was his

position as a social and moral critic. Rather than upholding a status quo and accepting the development of immorality within his region, Socrates worked to undermine the collective notion of "might make right" so common to Greece during this period. And, his attempts to improve the Athenians' sense of justice may have been the source of his execution.

As for Stephen being stoned to death, it is a story from the Bible. Amidst the rapid development of the church in Jerusalem, it appeared that there was a hint of discrimination. The problem was serious; immediate attention was required. To resolve the problem, the congregation selected seven men of good reputation, full of spirit and wisdom among themselves to oversee the daily ministry. The first man chosen was Stephen, indicating that he was the first choice of people. However, this godly man was later stoned to death by a mob of angry Jews. What happened was that: Stephen visibly taught the people of Jerusalem what he believed. Consequently, some Jews were convinced that Stephen was a leading figure and drive force of the church. They decided to confront him in a highly visible venue, believing that they could easily discredit him and turn back the hearts of the people. However, the outcome infuriated them. After that, the Jews attacked Stephen with false witnesses and accusations. After false charges had been leveled against him, Stephen was given the opportunity by the Jewish high priest to make a public defense of himself. However, instead of a defense to save his own skin, Stephen went on an offense for what he believed. What happened did not sit well with these Jewish leaders, and that ultimately cost him his life.

Giordano Bruno (1548—February 17, 1600) was an Italian philosopher best-known as a proponent of heliocentrism and the infinity of the universe. He is often considered an early martyr for modern scientific ideas, because he was burned at the stake as a heretic by the Roman Inquisition, a system of tribunals developed by the Holy See during the second half of the 16th century, responsible for prosecuting individuals accused of a wide array of crimes related to heresy (Griggs 1969).

Galileo Galilei (February 15, 1564—January 8, 1642) was an Italian physicist, mathematician, astronomer, and philosopher. He played a major role in the Scientific Revolution of the sixteenth to seventeenth centuries. He also defended heliocentrism, claimed it was not contrary to those Scripture passages, and openly questioned the veracity of the Book of Joshua (10:13), where the sun and moon were said to have remained unmoved for three days to allow a victory to the Israelites. In 1616, Cardinal Bellarmine, acting on directives from the Roman Inquisition, delivered Galileo an order not to hold or defend the idea that the Earth moves and the Sun stands still at the center. For the next several years Galileo stayed well away from the controversy. When his book, *Dialogue Concerning the Two Chief World Systems*, was published in 1632, Galileo alienated many of his defenders in Rome, include the Pope, and was ordered to stand trial on suspicion of heresy in 1633. With the court sentence he spent the rest of his life under house arrest.

The bottom lines, indicated in all these and relevant historical stories, are the same: Each individual or a small group of individuals has to be morally responsible for the well-being of their society; otherwise this individual or small group of

individuals will be run over by other people or elements of the society mercilessly, as concluded in Lin and Forrest (to appear 1–2) when they address the question of how individuals are morally responsible for their conducts. Specifically, the "well-being" of the society stands for the maintenance of both the mental inertia and the inertia of the field motion of the society. Speaking differently, each relatively stable society has its well adopted system of beliefs and philosophical values as well as a fully developed hierarchy of social structure. The relative stability means that the underlying yoyo field of the society rotates quite vigorously without any local pool spinning in a different direction. In such a uniformly spinning fluid, any rebellious local movement will undoubtedly be crushed mercilessly by the inertia of the vigorously spinning field of the society. As indicated by the dishpan experiment (Hide 1953; Fultz et al. 1959; or see Lin and Forrest (to appear 1–2) for a brief description of the experiment), for such a uniform spinning fluid to allow local eddy pools to exist, the local pools have to appear gradually at roughly the same time. So, one possible answer to the last part of Question 13.11 is that in order for one who pursues after his own desired success to avoid from traveling along the bloody trail created by mental inertia of the society, he has to control its field movement in conformation with the acceptable form of motion of the greater culture. As he obtains more support from others and causes many others to pursue after similar goals of success, the inertia of his greater environment will be altered by his effort. Just as what is well recorded in the history, this process will not be easy; it generally takes time; and it may well turn out to be the case that one gets such a trend of change started, and many others in the following generations devote their collective efforts and intelligence to eventually get the mental inertia of the greater environment altered.

13.3 Desire and Its Power

On the back of all achievement, all self-control, and all thought-control is there the magic something known as desire. It is the depth of this desire that it limits one from achieving high. When a person has strong desires, he/she would appear to possess supper human powers to achieve magnificently and to climb high (Hill 1928, pp. 185–186).

As a matter of fact, each and every personal and professional achievement starts from a strongly rooted desire. Desire is the seed of all magnificent achievement, the starting place, back of which there is nothing or at least there is nothing of which we have any knowledge. According to Hill's life time, intensive studies on achievements, it is discovered that each cycle of human achievement works more or less in the following fashion: First, form a picture and some objective in the conscious mind, derived on top of a definite purpose or goal based upon a strong desire; secondly, focus the conscious mind upon this objective by constant thinking of it and believing in its eventual attainment; thirdly, sooner or later the subconscious section of the mind takes up the picture or the outline of this

objective; that will impel one to take the necessary physical actions to transform that picture and objective into the eventual physical reality (Hill 1928, p. 250).

Because desire is so important for one to achieve magnificently in his personal and professional lives, then what is desire? To this end, there are several different studies. In terms of psychoanalysis, desire designates the impossible relationship that a person has with his objet petit a, meaning the unattainable object of his desire, which is sometimes also called the object cause of desire. According to French psychoanalyst and psychiatrist Jacques Lacan (1901–1981), desire proper (in contrast with demand) can never be fulfilled. Lacan argues that desire first occurs during a "mirror phase" of a baby's development, when the baby sees an image of wholeness in a mirror which gives him a desire for that being. As that baby grows older and matures as an adult, he still feels separated from himself by language, which is incomplete, and so the person continually strives to become the desired whole. He uses the term "jouissance" to refer to the lost object or feeling of absence which a person believes to be unobtainable (Evans 1996).

In terms of philosophy, the concept of desire has been identified as a philosophical problem since antiquity. For example, in *The Republic* written in approximately 380 BC, Plato (1991) argues that individual desires must be postponed in the name of the higher ideal. In Aristotle's *De Anima* (Polansky 2007), the soul is seen to be in motion, because animals long for various things and in their desire they acquire locomotion. Aristotle argues that desire is implicated in animal interactions and the propensity of animals to motion. At the same time, Aristotle acknowledges that desire cannot account for all purposive movement toward a goal. He posits that perhaps reason, in conjunction with desire and by way of the imagination, makes it possible for one to apprehend an object of desire, to see it as desirable. In this way, reason and desire work together to determine what is a good object of desire. This description resonates with that of desire in the chariots of Plato's Phaedrus, for in the Phaedrus (Plato 2005) the soul is guided by two horses, a dark horse of passion and a white horse of reason. Here passion and reason, as in Aristotle, are also together. Socrates (Kofman 1998) does not suggest the dark horse be done away with, since its passions make possible a movement toward the objects of desire, but he qualifies desire and places it in a relation to reason so that the object of desire can be discerned correctly, so that one may have the right desire.

In Passions of the Soul, Descartes (1649) writes of the passion of desire as an agitation of the soul that projects desire, for what it represents as agreeable, into the future. For Immanuel Kant (1790), desire can represent things that are not only the objects presently at hand but also absent; it is also the certain effects that do not appear and that what affects one adversely be curtailed and prevented in the future. The moral and temporal values are attached to desire in such a way that objects that enhance one's future are considered more desirable than those that do not. In 1740, David Hume suggests that reason is subject to passion. Motion is put into effect by desire, passions, and inclinations. It is desire, along with belief, that motivates action. Kant (1790) establishes a relation between the beautiful and pleasure. He says that "I can say of every representation that it is at least possible (as a cognition) it should be bound up with a pleasure. Of representation that I call

pleasant I say that it actually excites pleasure in me. But the beautiful we think as having a necessary reference to satisfaction." And desire is found in the representation of the object. Georg Wilhelm Friedrich Hegel (1807) begins his exposition of desire with the assertion that "self-consciousness is desire." It is in the restless movement of the negative that desire removes the antithesis between itself and its object, "… the object of immediate desire is a living thing…," and object that forever remains an independent existence. Hegel's inflection of desire via stoicism, a school of Hellenistic philosophy founded in Athens by Zeno of Citium in the early third century B.C., considering that destructive emotions are the result of errors in judgment, and that a sage, or person of "moral and intellectual perfection," would not have such emotions (Stanford Encyclopedia of Philosophy), becomes important in understanding desire.

In terms of emotions, desire stands for a sense of longing for a person or object or hoping for an outcome. When a person has the desire for something or someone, his sense of longing is excited by the enjoyment or the thought of the item or person, and he wants to take actions to obtain his goal. The motivational aspect of desire has long been noted by philosophers. For example, Thomas Hobbes (1588–1679) asserted that human desire is the fundamental motivation of all human action (Macpherson, 1962). According to the early Buddhist scriptures, the Buddha stated that monks should generate desire for the sake of fostering skillful qualities and abandoning unskillful ones (Bhikkhu 1996); and in one's training for his eventual liberation, he must work with motivational processes based on skillfully applied desire (Collins 1982, p. 251).

While desires are often classified as emotions by many, psychologists describe desires as something different from emotions and argue that desires arise from bodily structures, such as the stomach's need for food and the blood needs oxygen, whereas emotions arise from a person's mental state. Berridge et al. (2009) find that although humans experience desire and fear as psychological opposites, they share the same brain circuit. Kawabata and Zeki (2008) showed that the human brain categorizes each stimulus according to its desirability by activating three different brain areas: the superior orbito-frontal, the mid-cingulated, and the anterior cingulated cortices. Their work on pleasure and desire shows that reward is a key element in creating both of these states, and that a chemical called dopamine is the brain's "pleasure chemical". They also show that the orbitofrontal cortex has connections to both the opioid and dopamine systems, and stimulating this cortex is associated with subjective reports of pleasure.

Question 13.12 What is desire in terms of the systemic yoyo model?

Based on our systemic models of human endowments, character, and thought, developed in Lin and Forrest (to appear 1 & 2) and in this chapter, desire can be modeled as how one wants his underlying yoyo structure to be in terms of one of or any combination of its attributes: direction, orientation, spin intensity, and scale. In particular, along with the development of one's self-awareness, he naturally builds his reservoir of imagination and his $\pm$ function with its ever-expanding domain. By knowing himself and others, he senses either consciously or

unconsciously and either correctly or incorrectly how his yoyo field can be made uniform and even or different so that it does not have to rotate as vigorously, or flow in a certain direction, or orient in a certain way, or be a certain scale, as it has been. So, as the person matures, his desire changes over time due to his knowledge on how his field could be made uniform or different evolves.

This systemic model of desire explains why each desire designates an impossible relationship that a person has with the unattainable object of his desire or the object cause of desire. It is because as long as the person is alive, his underlying field has to rotate on its own without being constantly pushed by some external fields. For this end to hold, his yoyo field must have some degree of unevenness. Because one's initial desires appear along with the development of his self-awareness, they indeed start to occur during the mirror phase of a baby's development. However, instead of wanting to be whole, as claimed by Lacan (1901–1981) (Evans 1996), the baby just wants unconsciously to be more even than he is in terms of his underlying field structure. As the baby grows older, he continues to feel not as even as he likes. As a matter of fact, as he matures into an adult and as his self-awareness becomes more awakened, he may very well feel much more uneven than when he was a child, because with the growth in age he generally experiences more constant comparisons with others so that some of the unevenness in his own field become more obvious with time.

As for why individual desires must be postponed in the name of higher ideal, as written by Plato (1991) in approximately 380 BC, our discussions earlier indicate that individual yoyo fields or local eddy fields have to be morally responsible to the well-being of the society; otherwise, other people and elements of the society would run over these individuals mercilessly. So, if an individual does not postpone his personal desire in order to entertain the need of the society to achieve or maintain its relative stability, before long this specific individual will no longer exist physically; its yoyo field will be completely destroyed by the powerful, overwhelming flow of the field of the society. Here, corresponding to Plato's dark and white horses of the soul, the viability of an individual's field depends on its self-awareness about its own existence and those around him and its $\pm$ function on which he senses what to do.

In our modeling, the soul has been implicitly identified with the spin field of an individual. So, the soul is in spinning motion because of its internal uneven structure and acquires its locomotion because in its desire it rotates more vigorously. This end is slightly different of what Aristotle writes in his *De Anima* (Polansky 2007) and agrees with what he argues that desire is implicated in animal interactions and the propensity of animals to motion. Our discussion on how one's $\pm$ function is defined well illustrates how moral and temporal values are attached to desire in such a way that objects that enhance one's future are considered more desirable than those that do not, as written by Immanuel Kant (1790).

Because desire stands for how one wants his underlying yoyo structure to be, that is why desire along with the $\pm$ function motivates action, as claimed by David Hume (1740). This systemic model of desire surely agrees perfectly with Georg Wilhelm Friedrich Hegel (1807) that self-consciousness is desire, that it is in the restless movement of rotation that desire removes the antithesis between itself and

its object, and that the object of immediate desire is a living thing and forever remains an independent existence.

Question 13.13 Where is desire from?

Because desire is how one wants his underlying yoyo structure to be in terms of one of or a combination of its attributes: direction, orientation, spinning intensity, and scale, as described in the discussion of Question 13.12, desire comes from and is created by the differences naturally existing between human yoyo fields.

In recent studies, many have classified desires as emotions (VandenBos 2006), where emotion is defined to be a mental and physiological state associated with a wide variety of feelings, thoughts, and behavior (James 1984). In our work here, we have discussed concepts related to thoughts and bodily behaviors. As for feeling, it stands for the physical sensation of touch either through experience or perception and is also used to describe physical sensation apart from touch such as "a feeling of warmth" (Webster's Seventh New Collegiate Dictionary). That is, emotions are subjective experiences and experienced from an individual's point of view. Once again, our systemic model implies that each so-called feeling is also a mental record received and stored in the reservoir of imagination. So, desires are not exactly the same as emotions; but emotions surely play a role in the formation of desires.

Now, if we mean by human bodily structure the totality of the underlying yoyo field of a person, then indeed, as argued by psychologists, desires arise from bodily structures and comparisons between the bodily structures. This second part is more important. It indirectly implies that the appearance of desires is fundamentally different from the stomach's need for food and the blood needs oxygen.

As for how desire and fear are related, other than they share the same brain circuit (Berridge et al. 2009), our systemic model indicates that they are really the different sides of the same coin. In particular, desire describes the situation of how one wants for his yoyo structure to be due to comparisons with other field structures, while fear the situation of how one does not want to lose what he already has within his field that he feels either how his field structure is better than others or how his field could viably sustain itself.

Question 13.14 Why is desire so powerful in terms of dictating one's thinking and physical conduct?

Similar to thought, desire also stands for a local eddy in the reservoir of someone's imagination and is specifically caused by such stirs that are created from comparisons with and interactions between human field structures. That is, desire is a particular kind of thought pertaining to the structure and movement of one's own yoyo field. That explains why desire can help to create a thinking process in order to pull relevant information and knowledge in the reservoir of imagination together. To this end, pattern matches and the well-formulated $\pm$ function of the conscience work together to decide what is desirable and what is not. Because any bodily movement is simply a three-dimensional realization of the underlying multi-dimensional yoyo structure of man, it explains why desire is powerful to dictate one's physical conduct.

As for why the human brain categorizes each stimulus according to its desirability, as shown by Kawabata and Zeki (2008), it is because responding to each stimulus, various groupings of relevant information and known knowledge are formed in the conscious mind. These groupings are judged according to the $\pm$ function, and the grouping with the most desirable outcome, considering his relative stable preference or the instantaneous need or liking of the moment, is chosen. Now, each of the available stimuli is assigned a value of preference so that all the stimuli are naturally ordered according to their desirability.

Question 13.15 How can we determine the depth of one's desire that makes him appear to possess supper human powers in his pursuit of life-time goals?

The depth of one's desire is the intensity of the local eddy pool of the desire in the reservoir of imagination. From the discussions developed for the concept of thoughts, it can be seen that the stronger this local pool spins, the more relevant information and knowledge inside the reservoir will be pulled together, and the more recognizable its three-dimensional realization in the physical world will be. When the intensity of spin of the local pool reaches an extremely high level, an extraordinarily amount of materials of imagination will be pulled into the back hole of the pool, indicating that various innovative connections are established to bridge seemingly unrelated information and facts. Consequently, what is desired will become more attainable than before, because when these innovative connections are materialized in the physical world, they become valuable guidance as for where to look for potentially useful resources. This sort of guidance, invisible to others, makes the specific individual appear to possess super human power in his pursuit of magnificent achievements.

Question 13.16 Can desire be artificially strengthened or deepened?

According to the recent publications, see the references listed in Colvin (2008), the answer to this question seems to be YES. The authors of these published works looked at rewards and how various rewards can create or strengthen a desire. However, based on what we have accomplished in this work, rewards are only one side of the story of making one's internal yoyo structure uneven. The other side of the story is to create more obstacles in one's life, and at the same time to provide the person with the knowledge that when each obstacle is conquered, something magnificent will happen to him. When these two sides work together, his internal structure will effectively become more uneven much quicker than only one side of the story is applied. The theoretical reasoning behind this idea is that rewards provide the material and/or psychological indicators of recognition for progress toward the attainment of the desired goal; and the obstacles help to strengthen the internal drive for a local pool of desire to form and to spin vigorously.

The reason why Hill's (1928, p. 250) cycle of human achievement actually works can be analyzed as follows: With a strong desire (a fast rotating pool in imagination), if one has a firm and clear definition of success and how he can tell whether or not he has achieved his defined success, then his innovative connections of knowledge, formed on the basis of the strong desire, will guide him to the right direction to devote his attention, energy, and time for the eventual attainment

of the defined success. When his progress is hindered by unexpected difficulties, this guidance will provide possible ways for him to get around or tell him how to overcome the unexpected. And equally important, these innovative connections of knowledge will help him locate available resources both from within his reservoir of imagination and from the outside world useful and valuable to attaining his desired goal. By constantly thinking of the defined success and believing in its eventual attainment, one in fact keeps his eyes open and mind active in searching for possibilities that can be employed to his advantage in his attainment of his goal. By actively exercising his sense organs and mind for potentially available resources, his human endowments—self-awareness, imagination, conscience, and free will—will eventually make his underlying field structure spin in a necessary form. When this form of motion is realized in the three-dimensional physical world, it means that he has taken the necessary physical actions to transform his mentally defined success into the eventual physical reality.

13.4 Enthusiasm and State of Mind

By enthusiasm, it means intense enjoyment, interest, and/or approval. It represents a state of mind that inspires and arouses a person to put action into the task at hand. It is contagious to all with whom the enthusiast comes in contact. Enthusiasm is the vital moving force that expels action. The greatest leaders are those who know how to inspire enthusiasm in their followers. When one mixes his work with enthusiasm, the originally tedious work will no longer feel stressful or monotonous. Enthusiasm in general energizes one's entire body so that he can get along with little rest and enables him to perform from two to three times as much work as he usually performs in a given period of time without experiencing fatigue. Enthusiasm is a vital force that one can harness and use for good purpose and with which one recharges his body and develops a dynamic personality.

Some people are blessed with natural enthusiasm while others must acquire it. The procedure of developing enthusiasm is simple. It begins at doing the work or rendering the service one likes best. If one is so situated that he cannot conveniently engage in the work that he likes best, then he can for the time being proceed along another line very effectively by adopting a definite purpose or goal in life that contemplates him engaging in that particular work at some future time. That is, one may be a long way from realizing his definite goal in life, but if he kindles the fire of enthusiasm in his heart, and keep it burning, before very long the obstacles that now stand in the way of attaining that goal will melt away, and he will find him in possession of power that he did not know he possessed (Hill 1928, pp. 153–154).

To practically acquire enthusiasm for those who are not naturally blessed with the special state of mind, they only need to use the technique called self-suggestion (Hill 1928, p. 164) for a period of time until a small still voice within themselves starts to affirm that they will positively realize their goals. More specifically, the technique of self-suggestion works as follows: (1) Completely write out the

definite goal in clear and simple language; (2) Write out a relatively detailed plan on how to transform the goal into reality; (3) Read over the descriptions of the goal each night right before bed with full faith and enthusiasm in the ability to transform the definite goal into reality; and (4) While reading the description, imagine the full possession of the object of the goal.

Along with enthusiasm, one needs self-control to direct his enthusiasm to constructive ends. Enthusiasm is the vital force that arouses a person to action, while self-control is the balance that directs the action to build up instead of tear down. To this end, Napoleon Hill (1928, p. 175) studied 160,000 prisoners in the United States. He found that 92% of these men and women are in prison because they lacked the necessary self-control to direct their energies constructively. On the other hand, the records of those the world remembers as great indicate that each and every one of them possesses the quality of self-control.

Question 13.17 What is the systemic mechanism under the intense state of mind, known as enthusiasm, that it explains why enthusiasm inspires and arouses a person to put action into the task at hand and makes originally monotonous works more enjoyable to finish?

We have established the systemic mechanism for enthusiasm in Lin and Forrest (to appear 3), when we addressed the following question: Is it generally true that those who possess character have enthusiasm and personality sufficient to draw to them others who have character, as claimed by Hill (1928, p. 164)? To well address the second part of the current question, let us cite relevant details here.

By enthusiasm, it signifies a whole-hearted devotion to an ideal, cause, study or pursuit, or merely being visibly excited about what one's doing (Tucker 1972). As what has been modeled in Lin and Forrest (to appear 3), enthusiasm is a state of intensive spin of the underlying yoyo field of one's mind and body that has a specific tilt in the axis of rotation. When compared to the systemic model of self-motivation and self-determination, enthusiasm is the same as self-motivation and self-determination except that its state of intensive spin does not last as long as that of self-motivation and self-determination and that throughout the lifespan of enthusiasm, the intensity of spin might vary up and down alternatively.

To answer our current question successfully, we still need to address why a field spinning in its inertial state could suddenly acquire the momentum to rotate at a higher level of intensity in terms of its speed and strength. Based on our systemic yoyo model, there are only two ways for this phenomenon to occur. One is that a new unevenness in the structure of the field suddenly appears; and the other an ever-presenting field in the immediate neighborhood suddenly, unexpectedly disappears, breaking the inter-field equilibrium while providing some advantage to the field of our concern.

There are many different ways to cause a new structural unevenness to appear suddenly. One category of methods includes those about discovering new strengths in oneself. Another category contains methods about discovering new patterns of interaction with other fields. Discovering new strengths within oneself can be about finding not previously known, but realizable combinations of well-known

patterns of flow or different ways a specific flow pattern can be directed. For instance, one used to eat his breakfast, consisting of a bowl of cereal, a cup of milk, and a cup of fruit mix, in the following order. He first prepares and eats his bowl of cereal; after placing his bowl in the sink, he then fills up his cup with milk from a bottle in the refrigerator, waits a few minutes for his milk to be heated up before he drinks the milk. After he throws the cup into the sink, he once again reaches into the refrigerator the second time to get the big container with fruit mix to fill up his second cup. When this procedure becomes a routine, this person will naturally repeat the sequence of operation daily without giving any second thought to it. Now assume that one day for whatever reason he has to hurry up in the morning, he unconsciously finishes his breakfast as follows: When he prepares his bowl of cereal from the pantry, he also conveniently takes out the milk bottle and the container of fruit mix from the refrigerator. When filling up his bowl with cereal, he also fills up his cups with milk and fruit mix, respectively. When he returns the box of cereal back into the pantry, he also conveniently put the milk bottle and fruit mix container back into the refrigerator. While he is eating his cereal and fruit mix, his cup of milk is heated up. On his way to put his bowl and cup into the sink, he finishes his cup of milk so that he put all of his table wares into the sink at the same time. This simple example illustrates how we can improve the efficiency in many areas of our lives by focusing on ourselves.

As for discovering new patterns of interaction with other fields, it includes finding out more about others so that one's own behavior can be accordingly modified in order to take advantage of the new discovery and to achieve much improved effectiveness. For instance, in a sales situation, a large commercial customer bought many units of a certain product. That is great for the salesman! And to most salesmen, the story stops right there and when he receives his fat commission check. However, if a salesman has his eyes open for discovering new patterns of interaction, he might very well feel curious as for why the customer bought so many units of his product. After actually checking into the details with the representative of the commercial buyer, he may surprisingly find out how the buyer actually uses his products to benefit many other well-known companies. Now, equipped with this new knowledge, the salesman will undoubtedly feel very excited about his product and will surely brag about it to other potential buyers. This end in practice may create many more major sales for the salesman in the weeks, months, and even years to come.

So, when a new structural unevenness appears suddenly within one's yoyo field either by discovering new strengths within himself or by realizing new patterns of interaction with others, his underlying field obtains a boost in its intensity of spin. As one field suddenly spins at a greater strength, the following First Law on State of Motion implies that in comparison all other fields in the neighborhood will still be moving in their individual inertial states.

The First Law on State of Motion (Lin 2007): *Each imaginable and existing entity in the universe is a spinning yoyo of a certain dimension. Located on the outskirt of the yoyo is a spin field. Without being affected by another yoyo*

structure, each particle in the said entity's yoyo structure continues its movement in its orbital state of motion.

This fact implies that the strengthened field senses the potential of winning various scores against all other fields with the broken equilibrium. It is because its movement suddenly experiences fewer constraints from other fields. When the field of suddenly increased intensity is realized in the three-dimensional space, it makes people feel that his enthusiasm has inspired and aroused him to put action into the task at hand. And this three-dimensional realization makes the person himself feel that his enthusiasm makes originally monotonous works more enjoyable to finish. Here, both the task at hand and the originally monotonous works have been reflected in the form of spinning motion of the specific field before it suddenly gains its unexpected intensity. As a matter of fact, these feelings are truthful reflections of the state of affairs, because the fact that this specific field is spinning at a much increased intensity while others are still rotating in their individual inertial states implies that this fast moving field can suddenly accomplish many objectives that he could not easily accomplish before.

Similar analysis can be carried out for the situation when an ever-presenting field in the immediate neighborhood suddenly and unexpectedly disappears. It is because the sudden and unexpected disappearance of a neighboring field breaks the inter-field equilibrium of the neighborhood. This sudden loss in the inter-field balance in actuality creates an imbalance or unevenness within the said field. So, this external imbalance is immediately transformed into a situation of internal unevenness. What is a little different from what is just analyzed above though is that when such an inter-field imbalance appears unexpectedly, all the fields of the neighborhood are affected with expected appearance of internal unevenness. So, whichever field that does expect such a change from occurring would have its advantage over other fields.

This yoyo field modeling indeed explains vividly why enthusiasm stands for intense enjoyment, interest, and/or approval. The so-called intense enjoyment and interest come from one's sudden liberation from the constant constraints of other fields. As the field of increased intensity spins faster than before, as it would like to base on the unevenness of its internal structure, it does experience an ease, which can be expressed as an intense enjoyment and interest. Because suddenly the field suffers from less constraint from others, it feels like that its behaviors have been approved by these less constraining fields.

To address why enthusiasm is a vital force with which one recharges his body and develops a dynamic personality. Let us first look at the concept of personality. According to Allen (2005), personality stands for one's aggregate conglomeration of decisions he has made throughout his life. There are inherent natural, genetic, and environmental factors that contribute to the development of one's personality. The systemic model of personality, developed in Lin and Forrest (to appear 3), says that the so-called personality is the subsystem of one's character that consists of all the three-dimensional realizations of his optimal patterns of field flow and field interactions that show how he related and reacted to others, to various stimuli, and to the environment. Combining this model with what we just discussed,

enthusiasm indeed makes one more dynamic, spinning at a increased intensity, in terms of how he would proactively relate and react to others, to stimuli, and to the environment.

Question 13.18 What is the connection between great leaders and their own enthusiasm? How is their own enthusiasm spread over to their followers?

To address this question adequately, let us first look at what is meant by leadership. As a matter of fact, leadership is one of the most salient aspects of the organizational context and a difficult concept to define. It is defined as the process of social influence in which one person can enlist the aid and support of others in the accomplishment of a common task (Chemers 2001), or ultimately about creating a way for people to work together and to make something extraordinary happen (Kouzes and Posner 2007). In the research of leadership, many different theories have been developed by various authors.

For example, the trait theory, which was initiated by Thomas Carlyle (1841), attempts to identify the talents, skills, and physical characteristics of men that are associated with effective leadership (House 1996). Kirkpatrick and Locke (1991) argue that key leader traits include: drive (a broad term which includes achievement, motivation, ambition, energy, tenacity, and initiative), leadership motivation (the desire to lead but not to seek power as an end in itself), honesty, integrity, self-confidence (which is associated with emotional stability), cognitive ability, and knowledge of the business. Facing criticism, recent studies of the trait theory identify leadership skills, not simply a set of traits, but as a pattern of motives suggesting that successful leaders tend to have a high need for power, a low need for affiliation, and a high level of self-control (McClelland 1975).

Spencer (1841) argues that it is the times that produce the leaders and not the other way around. This theory assumes that different situations call for different leadership characteristics. According to this group of theories, no single optimal psychographic profile of a leader exists, and what an individual does, while acting as a leader, is largely dependent upon characteristics of the situation in which he functions (Hemphill 1949). It is found (Van Wormer et al. 2007) that

1. The authoritarian leadership style, in which the leader makes decisions alone, demands strict compliance to his orders, and dictates each step taken, to a large degree future steps were uncertain to others, is approved in periods of crisis but fails to win the hearts and minds of the followers in the day-to-day management;
2. The democratic leadership style, in which collective decisions, assisted by the leader, are made, before accomplishing any task, perspectives are gained from group discussions, members are given choices and collectively decide the division of labor, and feedbacks are given by individual group members, is more adequate in situations that require consensus building; and,
3. The laissez faire leadership style, in which freedom is given to the group for policy determination without any participation of the leader, who remains uninvolved in work decisions unless asked, does not participate in the division of labor, and very infrequently gives praise, is appreciated by the degree of

freedom it provides, but as the leader does not "take charge", he can be perceived as a failure in protracted or thorny organizational problems.

That is, leaderships and their styles are contingent to the situation.

According to the functional theory, the leader is responsible for making sure whatever necessary to his group's needs is taken care of. So, he is detrimental for his group's effectiveness and cohesion (Wageman et al. 2008). This theory has most often been applied to team leadership as well as organizational leadership. According to this theory, there are five broad functions a leader provides when he promotes his unit effectiveness. These functions include: environmental monitoring, organizing subordinate activities, teaching and coaching subordinates, motivating others, and intervening actively in his group's work.

A formal organization (Cecil 1970, pp. 884–889) is such a human hierarchy that it is established for achieving defined objectives. It consists of divisions, departments, sections, positions, jobs, and tasks so that the entire organization would behave impersonally in regard to relationships with clients and with its members. Based on merit or seniority employees are ranked so that the higher one's position is in the hierarchy, the greater his presumed expertise and social status. It is this bureaucratic structure that heads are appointed for administrative units and they are endowed with the authority corresponding to their positions. Now, other than the appointed administrative chief, a leader may still emerge informally, which underlies the formal organizational structure. He is the leader of the underlying informal organization that is made up of the personal objectives and goals of individual employees. The unchanging human needs—personal security, maintenance, protection, and survival—of the employees are met by the informal organization and its emergent leaders (Knowles and Saxberg 1971, pp. 884–889).

Each informal leader influences a group of employees toward obtaining a particular result. He does not depend on any title or formal authority. Instead, he is recognized by his capacity for caring for others, clear communication, and a commitment to persist (Hoyle 1995). On the other hand, although each appointed manager has the authority to command and enforce obedience, he still has to possess adequate personal attributes to match his authority, because the authority is only potentially available to him. In the absence of sufficient personal competence, a manager may be confronted by an emergent unofficial leader, who can challenge the manager's role and reduce it to that of a figurehead. Since only authority of position has the backing of formal sanctions, it follows that whoever wields personal influence and power can legitimize this only by gaining a formal position in the organizational hierarchy with commensurate authority (Knowles and Saxberg 1971, pp. 884–889). Therefore, leadership can be defined as one's ability to get others to willingly follow. Every organization needs leaders at every level to achieve functionality and efficiency.

Now, let us look at the systemic model and analysis of the concept of leadership. Based on the definitions (Chemers 2001; Kouzes and Posner 2007), leadership is one's capability to adjust his underlying field structure so that many other neighboring fields would spin in similar fashions without much difficult

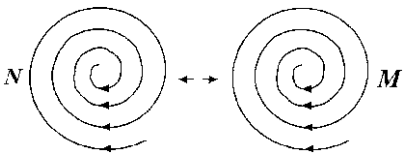

Fig. 13.8 Convergent fields spinning harmonically

readjustment. In particular, if one can utilize a process of social influence to obtain aids and support of others in accomplishing a common task (Chemers 2001), it implies that there has appeared a big whirlpool (the common task). This pool might initially be conceptual and physically invisible. However it does cover a large territory, within which many smaller fields (individual people) are located. Now, the leader is the person who can realign all the individual eddy fields in such a way that the conceptual large field becomes a visible reality. This exact analysis can be used to understand the definition of leadership of (Kouzes and Posner 2007), where the initially invisible large field is the expected something extraordinary.

With this systemic model of leadership, we can unify all the relevant studies into one organic whole. For instance, to be a leader, it is indeed important for a person to possess some key elements, such as talents, skills, and physical characteristics, as claimed in the trait theory (House 1996). Let us now see why the key elements include drive, leadership motivation, honesty, integrity, self-confidence, cognitive ability, and knowledge of the business, as argued by Kirkpatrick and Locke (1991). First of all, according to what we have analyzed in Lin and Forrest (to appear 1–2), drive stands for the intensity of spin powered from within, caused by the internal unevenness of one's field structure. Evidently, from the First Law on State of Motion, it follows that only such a field has the potential to drag other fields along to spin harder. As for why leadership motivation is a key, it is because when a conceptual large field appears, several existing yoyo fields might play the leadership role, meaning that each of these fields fits the form of motion of the conceptual field in one way or another. As implied in the study of centralized and centralizable systems (Lin 1988), these potential leaders have to work something out in order to form a cohesive whole either through fighting off those fields which are fundamentally different or through forming coalitions with each other. As analyzed in Lin and Forrest (to appear 3), only when convergent fields spin harmonically (Fig. 13.8), they have the tendency to compromise and to form a greater field; in all other possibilities, no fields can potential compromise with one another. That is, to be a leader, one needs to devote extra amount of time and energy to deal with other fields pleasantly and unpleasantly. That explains why leadership motivation is a key element for leadership.

As for honesty, integrity, self-confidence, cognitive ability, and knowledge of the business, they are involved with accurate thinking based on the available resources in one's reservoir of imagination, where the person's identified self is located, within or outside of the domain of his $\pm$ function, and his ability to apply his human endowment free will (or his ability to make short-term predictions)

Our modeling and analysis indeed indicate that patterns of field movement are the fundamental reason why a person would become a leader. His overreaching field influence on others (due to a high degree of intensity of spin) makes him seen as having a high need for power, a low need for affiliation (because he attracts others to him and not the other way around), and a strong self-control (that is thought-control, in which one deliberately chooses his thoughts based on accurate and realizable information to dominate his mind and firmly ignores all outside suggestions that are not congruent with his thoughts (Lin and Forrest, to appear 3)).

At the same time, our modeling and analysis explain why, as argued by (Spencer 1841), it is the times that produce the leaders and not the other way around and that different situations call for different leadership characteristics. In particular, different situations stand for different forms of field motion. To fit a situation well, where the situation stands for the existence of a conceptual field structure, only those whose fields are in conformation with the conceptual field motion will potentially become the leader. This end verifies that there is not any single optimal psychographic profile for leadership, and that what an individual does, while acting as a leader, is in large part dependent upon field characteristics of the situation in which he functions.

Other theories of leadership can be analyzed similarly. All the details are omitted here. To finish our discussion here, let us now turn our attention to address Question 13.4.2.

A leader creates his high degree of spinning intensity by making use of an emerging, overreaching, and overpowering conceptual field structure. So, his leadership ability is his enthusiasm. In other words, the leader's increased field intensity is the result of his structural consonance with the emerging large field and this increased intensity also stands for a newly acquired enthusiasm. This enthusiasm is spread over to the leader's followers by utilizing his increased intensity of spin combined the field influence of the conceptual field motion, when other fields are still in their individual inertial states of motion.

Question 13.19 When one is situated in a difficult situation and a long way from realizing his definite goal in life, what is the underlying mechanism for him to be able to kindle the fire of enthusiasm in his heart and keep it burning? And why is that before very long the obstacles that now stand in the way of attaining one's definite goal will melt away, and he will find him in possession of power that he did not know he possessed?

First, when one has a definite goal in life, it means that in one way or another, he has been terribly stirred or troubled when his established world view and belief system was somehow turned upside down at least partially, for details see the discussion for Question 13.9. From that discussion, it is followed that the definite goal is formulated more or less through the following procedure.

1. When one faces a troubling stir, his self-awareness takes in the new information and mobilizes his entire reservoir of imagination to formulate a response by making use of his conscience (the $\pm$ function) and free will (the ability to make at least short-term predictions).

2. To respond to the stir, various groupings of relevant information and knowledge are formed in the conscious mind.
3. These groupings are judged by using his ± function of his conscience. Among all the groupings with + response values, he picks out the one response with the most desirable + value.
4. Along with the fully activated mind, his sense organs become keen to whatever in the surroundings that is supportive to his chosen response.
5. Accompanying the fully activated mind and stimulated sense organs, his entire underlying multi-dimensional yoyo structure of the person starts to act in various harmonic ways correspondingly.

Now, when this person feels that he is situated in a difficult situation and a long way from realizing his definite goal in life, it simply means that his newly adjusted yoyo structure is experiencing great resistance from the surrounding fields due to the inertia of their individual movements. If for whatever reason the external stir is truly troublesome and severe, then he will naturally have a burning desire to materialize his imagined outcome in the physical world in order to even out the imbalance created by the stir in his reservoir of imagination and the associated ± function of his conscience. This burning desire stands for how he wants his underlying yoyo structure to be in terms of its attributes: direction, orientation, spin intensity, and scale (see the discussion of Question 13.12 above). Now, the newly created (by the stir) severe unevenness in his field structure explicitly implies the appearance of a much increased intensity of spin. This state of intensive spin is exactly an enthusiasm the person recently acquired. So, there is no need for the person to kindle the fire of enthusiasm no matter how difficult situation he is in and what a long way he is from realizing his definite goal in life. As for how he can keep his enthusiasm burning in his heart, our analysis indicates that as long as he does not settle for less, meaning that he would not allow any state of field motion between the current chaotic state and his desired state to be acceptable, his fully activated mind and stimulated sense organs will continue to look out for whatever supportive to achieve his desired outcome.

If the person can keep his enthusiasm burning in his heart, it means that his underlying field is kept spinning at its newly acquired momentum and intensity, the First and the following Third Laws on State of Motion imply that all the other field structures, which used to resist the change in the person, will have to change their forms of motion accordingly in an accommodating way. This end explains why before very long the obstacles that now stand in the way of attaining one's definite goal will melt away, and he will find him in possession of power that he did not know he possessed. Here the power is that he can change behaviors of others according to his likings.

The Third Law on State of Motion (Lin 2007): When the spin fields of two yoyo structures N and M act and react on each other, their interaction falls in one of the six scenarios as shown in Figs. 13.9a–c and 13.10a–c. And, the following are true:

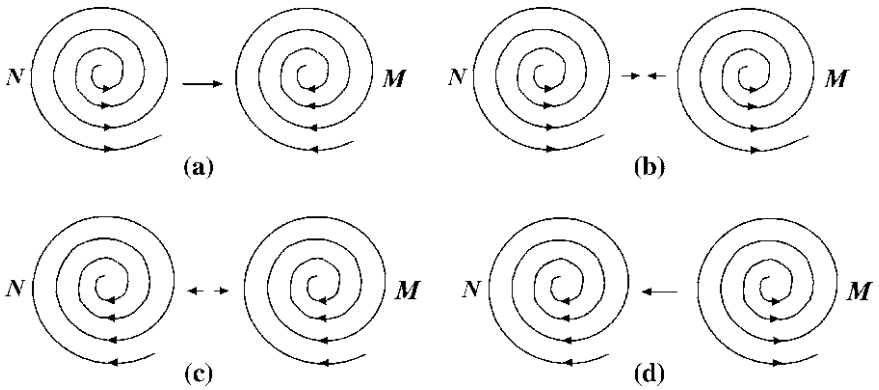

Fig. 13.9 Same scale acting and reacting spinning yoyos of the harmonic pattern. **a** *N* diverges and *M* converges. **b** Both *N* and *M* diverges. **c** Both *N* and *M* converge. **d** *N* converges and *M* diverges

1. For the cases in (a) of Figs. 13.9 and 13.10, if both N and M are relatively stable temporarily, then their action and reaction are roughly equal but in opposite directions during the temporary stability. In terms of the whole evolution involved, the divergent spin field (N) exerts more action on the convergent field (M) than M's reaction peacefully in the case of Fig. 13.9a and violently in the case of Fig. 13.10a.
2. For the cases (b) in Figs. 13.9 and 13.10, there are permanent equal, but opposite, actions and reactions with the interaction more violent in the case of Fig. 13.9b than in the case of Fig. 13.10b.
3. For the cases in (c) of Figs. 13.9 and 13.10, there is a permanent mutual attraction. However, for the former case, the violent attraction may pull the two spin fields together and have the tendency to become one spin field. For the later case, the peaceful attraction is balanced off by their opposite spinning directions. And, the spin fields will coexist permanently.

Question 13.20 The technique with which one can fix any idea he chooses in his mind is called self-suggestion. What is the theoretical foundation for this technique of self-suggestion to work?

What the First Law on State of Motion suggests is that the mind, when seen as a part of the person's underlying yoyo structure, experiences inertia in its ordinary operation. It is occupied by accustomed thoughts, repeatedly used logic of reasoning, often visited facts, etc. So, to sow a chosen idea into the mind and make it the center of focus, one has to fight his very own field structure against all the dominating parts, which are in their individual inertia states of motion. Only after this new center of focus exerts a constant force on the other parts over a period of time, the states of motion of the other parts will alter their respective forms of movement in order to accommodate the existing change in their environment.

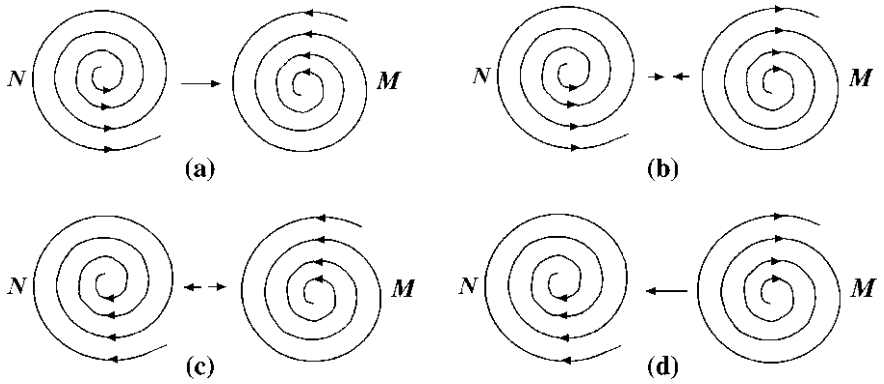

Fig. 13.10 Same scale acting and reacting spinning yoyos of inharmonic patterns. **a** *N* diverges and *M* converges. **b** *N* converges and *M* diverges. **c** Both *N* and *M* converge. **d** *N*c onverges and *M* diverges

Here, the key is that this new center of focus has to be established permanently and exerting constant pressures on the other parts of the mind first before the other parts would accept its existence and yield to its influence.

What Hill (1928, p. 164) suggests on how to apply self-suggestion in fact implies how one should make his predictions using his free will on the realization of his goal (by writing out a relatively detailed plan). If this plan is made on accurate thoughts, then the person would not have any trouble to form a specifically intensive spin in his reservoir of imagination. And as we have discussed previously, when such a specific spin is formed in his field structure, its realization in the three-dimensional space will be recognized in no time.

Question 13.21 Why is self-control so important that it can direct enthusiasm to constructive ends, to build up instead of tear down?

Because enthusiasm is a state of intensive spin of one's underlying yoyo field, it can of course be realized in the three-dimensional space with one of the following three possibilities: a constructive consequence, no contribution to the society whatsoever, or a destructive end. Now, the so-called self-control is simply the thought-control, each thought a local eddy pool in the reservoir of imagination, and thinking process the process of generating a local pool by pulling relevant information and knowledge together to form an organic whole.

For a person, if his identified self is located within the domain of his $\pm$ function of his conscience with a + value, then assuring about a constructive consequence being realized in the three-dimensional space out of his enthusiasm, he would constantly compare each newly formed component in his thought with the definition of his $\pm$ function. If an imagined pattern of field flow does not have an already assigned $\pm$ value, further thinking will be needed until a definite value is provided. If a pattern has an assigned—value, the pattern has to be either erased out of the local eddy pool of the thought or modified to insure a consequent + value.

As we have discussed in Lin and Forrest (to appear 2), how one would react to a stimulus is dependent on where his identified self is located, either inside the domain of his $\pm$ function or outside, and even if his identified self is inside the domain, it is also dependent on what value is assigned to the self. So, the analysis in the previous paragraph will change from one person to another.

In this chapter, with the help of the systemic yoyo model, we have gained some brand new understanding on human desire and enthusiasm, two most important driving forces behind every great success ever recorded in history. What is most practically important of this work is that these driving forces can be purposely developed in any person of average intelligence. As of this point, what is still left open is how to specifically design programs to help people develop these vital forces in their personal as well as in professional lives.

Also, by using the systemic yoyo model, we have considered in this chapter many important, unsettled problems investigated by many scholars throughout the history since antiquity without reaching scientifically satisfactory results. All of our results and discoveries are derived on the basis of the systemic yoyo model. This model not only works as the common framework of our discussions and but also plays the roles of systematic reasoning and thinking logic. Because of the introduction of this rigorously proven methodology, we are able to establish the related key concepts on a unified foundation, overcoming the weakness of the relevant studies of the past of having no solid ground for relatively rigorous reasoning. As expected in Lin (2007) and as shown in this and previous chapters, this systemic yoyo model is indeed useful in the studies of social science and humanities.

Chapter 14
Happiness, Fear, and Forced Struggle

In this chapter, we will explore the underlying systemic mechanisms of happiness, fear, and self-confidence, and the advantages and values of forced labor, the structure of the mind, and the human nature by employing the recently established systemic yoyo model as the playground, intuition, and the foundation for the reasoning. We will show the connection between happiness and fear using systemic structures and how theoretically self-confidence can be established in any person of average intelligence. It is expected that these results can find their practical applications in educational settings in terms of introducing innovative programs for producing quality students and profitable employee trainings.

Because of the use of the systemic yoyo model, we are able to establish the first time in history a unified theoretical foundation for all the most important concepts about how the human mind works, and produce interesting conclusions. The difficulty underlying all the past relevant investigations is a lack of methodology suitable for deriving convincing theoretical results and practically beneficial consequences. Our works in this and previous chapters surely have more than enough remedied this deficiency. This chapter is mainly based on Lin and Forrest (to appear 5 and 6).

In particular, in Sect. 14.1, we investigate happiness by looking at the following questions. How can happiness be modeled using the systemic yoyo model so that we can prove the existence of principles upon which enduring happiness and success are based? How can we show Aristotle's statement that happiness is the only endeavor that humans pursue after for their own sake, observing that men sought wealth, honor, or health, not for their own sake but to be happy? Is it theoretically possible for humans to behave both individually and collectively in order to achieve the expected resulting happiness of such behavior, as John Stuart Mill and Jeremy Bentham advocated? Corresponding to the biological studies of happiness by using evolutionary perspective, what new insights on happiness can be obtained by using the concept of whole evolution in systems science? Why is it true, according to the positive psychology, that when one exercises his unique

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strengths and virtues for a purpose greater than his own immediate goals, he will have a chance to experience the most profound sense of happiness?

Here are some of the highlights of our conclusions developed in this section. When a person feels happy, it means that at that moment his underlying yoyo field just achieved an upper hand over a resistance in its movement against some other field flows in its environment. This definition includes the meaning of living a good life or flourishing, and the meaning of pleasure for felt experience(s), as how happiness is used in the daily language of our modern day. From this systemic model, what Aristotle states about happiness naturally follows. That is, happiness is the satisfactory conclusion of any endeavor that is difficult to pursue in the material world with successful consequence. By using the concept of whole evolution (Lin 1998a, b), it is argued that when a person has a happy life, it means that throughout his life, he experiences victorious moments one after another, that one way for a person to live a life of enduring happiness is to have such a definite goal that its realization is not very well defined so that he can only feel the gradual realization of the goal without any specific means to check on the progress, and that limiting oneself within a well defined boundary can only provide the person a temporary state of happiness, even if his field is no less powerful than any other fields within the border.

In Sect. 14.2, we look at the systemic mechanisms under the six basic fears each person experiences one time or another and self-confidence that separate those who are successful and the rest of the mass along with the following open questions. Where did I come from? Where am I going after death? What is making the difference between the privileged a few who advance quickly to a respected social status and highly paid positions and the rest of the mass who seem to stay still in their daily routines? What is the systemic mechanism for such a difference that separates the privileged a few of any society from the rest of the mass? Is there a definite method through which self-confidence can be developed in any person of average intelligence? At the end of this section, we provide a systemic yoyo model analysis for the Law of Mental Telepathy, as proposed by Hill (1928, p. 131).

Among other interesting results, we obtain that one's fear of criticism is a natural consequence of the constant battles between the person and all other systems in his environment, similar to the appearance of his self-awareness. His underlying systemic yoyo field prompts him not only to take away elements, such as goods and wares, from other spinning fields, but also to justify his action with criticism of his fellow man's character. The fear of criticism can be powerful and mighty, because each individual has to be morally responsible for the inertial of movement of his society. As for the fear of loss of love of someone, the systemic mechanism is established by using the concept of n-nary star systems, for any natural number $n > 1$, where a loss of love naturally throws the other spinning fields into an unexpected chaotic state of motion. The foreseeable state of uncertainty and extinction of the existing system makes one fear the loss of love from that special someone. The fears of poverty, ill health, old age, and death, are all related to that of death. As for where we are from at birth or where we go at death, it is shown that each person is born out of one of two kinds of yoyo field

interactions without past experience; and when a field becomes too weak, its components will simply be absorbed by other powerful, mighty fields spinning in more or less harmonic forms.

As for self-confidence, we show that it is closely related to one's ability of making predictions in his free will and why the majority of the mass suffer from problems in either self-awareness, or the quality of information stored in their imagination, or the ability of making predictions within their free will. And for most cases, there is a definite way to develop self-confidence in any person of average intelligence.

In Sect .14.3, we investigate forced struggles in life by studying the following questions: What is the systemic mechanism for why any forced struggle in life is a decided advantage? Why cannot any person who exercises complete self control be permanently defeated? Do enemies always exist? Other than their annoyances, are enemies important to have?

What we establish in this section, among others, include: Both ambition and self-confidence are fundamentally determined by the degree of unevenness in the internal structure of the person. Any forced struggle in life is equivalent to the situation that an ever-presenting field of the environment suddenly, unexpectedly disappears so that one has to fill the vacuum left behind by the departed field. If one desires to get more in his life and instead of demanding more of himself he wants others to provide him, then he will have to face two possibilities: (1) his demand cannot be met; or (2) he will be pulled back down from realizing his desire by others. Any person who has a complete grip over his own thoughts possesses such an ability that he can maneuver over the form and movement of his thought pools in his imagination. In this case, the person will be able to create a new pattern of flow to offset any local blockage appearing in the originally spinning field. And if his internal yoyo structure is extremely uneven, then his field will be rotating on its own with a high level of intensity and most regional blockages will not create any trouble for him at all, because his field will simply push the blockages along without any need to alter its pattern of flow. Each person's underlying spinning yoyo field is characterized by its stirring (or rotational) momentum (m) and the stirring (or rotational) kinetic energy (m^2). The quasi-stable existence of natural materials is caused by the conservation of the quasi-three-ringed stirring energy. To identify enemies, one singles out those who seemingly attempt to destroy the temporarily stable three-ringed circulation structure existing in his underlying spin field. Based on the field structures of enemies, it is shown that enemies are those who discover one's weaknesses and various temporary defeats and point them out to him. Their constant reminders of one's shortcomings make enemies important for him to keep himself on track. This section is concluded by looking at the law of attraction between human beings.

In Sect. 14.4, we discuss the systemic yoyo structure of the mind and derived the following conclusions among others. To materialize the ultimate goal of happiness, one has to cultivate all of his four human endowments, self-awareness, imagination, conscience, and free will by utilizing varieties of thoughts and inspiring stimuli. The mind, as a multi-dimensional yoyo, functions like a magnet

that it can attract useful ideas from all sources. Because voluntary body movements are harmonic to dominating thoughts of mind, when a definite goal is deliberately fixed in the mind with the determination to realize it will eventually lead to necessary physical actions of the body toward materializing that goal. When seeing one's own field floating in a rough sea of eddy pools of the universe, it becomes obvious that however a yoyo spins, it creates some sort of conflicts with spinning yoyos it comes in contact with. In its interactions with others, one inevitably has to experience self-doubt or skepticism about his established goal and the potential of his eventual attainment. That explains why skepticism has been known as the deadly enemy of progress and self-development and why the development of self-confidence and enthusiasm starts with the elimination of different forms of fear.

Because mind is a spinning yoyo, its spin field consists of various local pools, each of which stands for a habit, a motion unconsciously repeated. That is why to alter a habit, a mighty external spinning yoyo is needed. When a yoyo experiences a fast current in the ocean of spinning yoyos, it is not enough for it to simply strengthen its own rotation in order to fight off the impact of the strong current; instead, it also needs to adjust its own orientation and to harmonize itself with the other yoyos in the currents. Through social hereditary, one possesses many mental paradigms on how other yoyos should and would behave. Most people believe what they see is what things are or what things should be. Their attitudes and consequent behaviors grow out of this belief. However, our analysis suggests that how one rotates as an abstract spinning yoyo determines how he sees things; and how he sees things is the source of the way he thinks and the way he acts, as indicated by the Heisenberg's principle of uncertainty. So, mental paradigms are important and powerful. Through them, as a lens, one sees other spinning yoyos.

In Sect. 14.5, we study the systemic human nature. Among many interesting results, we establish the following results. If one desires to make a significant change in his life, he has to change the pattern of his underlying field's motion. Each yoyo structure follows certain rules or principles to be visibly or conceptually viable. So, there are principles that govern personal and professional success no matter how success is defined individually. No matter how these principles can be different for one definition of success to another, their systemic forms stay the same, representing laws of nature just as those laws of physics. Paradigms, produced out of prior experiences, are never the true picture as for how each of the underlying yoyos holds up viably and interact peacefully or violently with each other. Instead, they are only a subjective reality and merely an attempt to describe the true picture. All forms of life are subeddies born out of the interaction of two large scale spinning yoyos. As the parental yoyo structures gradually deteriorate, the become independent.

For one to survive the intense competition of various relationships, he has to center himself on the laws that govern the basic operations of spinning yoyos. For him to achieve a leadership position in the flow of eddy pools, he must comply with the laws that govern growth, development, and success. From the highs and lows the ocean of yoyos of the universe experiences, it follows that

interdependence is more realistic, advanced concept than that of independence. To reach the ultimate state of happiness, one has to rely on the natural laws that govern how systemic yoyos operate and the laws that govern the attainment of success. As one lives the natural laws that govern the operation of yoyo fields as a systemic human being, he will be able to define himself from within, rather than by other people's opinions or by comparisons to others. And, he will be able to know more of and understand more about what others think of themselves and how they like to relate to you.

14.1 The Systemic Structure Underlining Happiness

According to Cambridge Advanced Learner's Dictionary (2008), happiness means a state of mind or feeling, such as contentment, satisfaction, pleasure, or joy. It is the ultimate objective of all human efforts and can be maintained only through the hope of future achievement. Happiness lies always in the future and never in the past. The happy person is always the one who dreams of heights of achievement that are yet unattained (Hill 1928, p. 153). According to Covey (1989, p. 23), there are principles upon which enduring happiness and success are based. Throughout the history, a variety of philosophical, religious, psychological, and biological approaches have been taken to defining happiness and identifying its sources.

Happiness has been often defined by philosophers and religious thinkers in terms of living a good life, or flourishing, rather than simply as an emotion. Happiness in this sense is still used today in virtue ethics. In the daily language of the present day, however, terms, such as well-being or quality of life, are ordinarily used to represent the classical meaning, and the word of happiness is reserved for the felt experience or experiences that philosophers historically called pleasure.

Specifically, Mencius, a Confucian thinker who lived about 2,300 years ago, writes that the mind plays a mediating role between the "lesser self" (the physiological self) and the "greater self" (the moral self) and that getting the priorities right between these two selves would lead to sagehood. He argues that if people did not feel satisfaction or pleasure in nourishing their individual "vital force" with "righteous deeds," that force would shrivel up (Mencius 1895 6A:15, 2A:2). In particular, he mentions the experience of intoxicating joy if one celebrates the practice of the great virtues (Chan 1963). Patanjali, a Hindu thinker who lived about one hundred years after Mencius and the author of the Yoga Sutras, wrote quite exhaustively on the psychological and ontological roots of bliss (Levine 2000). In the Nicomachean Ethics, written in about 350 B.C., Aristotle (2003) states that happiness is the only endeavor that humans pursue after for their own sake, observing that men sought wealth, honor, or health, not for their own sake but to be happy. For Aristotle, happiness, which is the modern translation of the original word eudaimonia, is an activity rather than an emotion or a state. It is characteristic of a good life, in which a man or woman fulfills human nature in an excellent way. Each person has a set of humanly purposes. The happy person is

virtuous with outstanding abilities and emotional tendencies that allow him to fulfill his common human ends. For Aristotle, happiness is the practice of virtue.

In the recent history, philosophers made arguments for how humans should behave both individually and collectively based on the resulting happiness of such behavior. For example, John Stuart Mill (1863) and Jeremy Bentham (1789) advocated the greatest happiness principle as a guide for ethical behavior.

In terms of biological studies of happiness, the evolutionary perspective offers an approach to understand what happiness or quality of life is about. Scholars in this area of research try to address such questions as: What features are included in the brain that allows humans to distinguish between positive and negative states of mind? How do these features improve the survivability of humans? Detailed presentations of this perspective can be found in Grinde (2002, a).

In the area of positive psychology, Martin Seligman (2004) describes happiness as consisting of positive emotions and positive activities. He categorizes emotions into those related to the past, present, and future. Positive emotions relating to the past include satisfaction, contentment, pride, and serenity. Positive emotions relating to the future include optimism, hope, and trust. Positive emotions about the present are divided into two categories: pleasure and gratifications. The bodily and higher pleasures are pleasures of the moment and usually involve some external stimulus. The good life comes from using signature strengths to obtain abundant gratification in, for example, enjoying work and creative activities. The most profound sense of happiness is experienced through the meaningful life, achieved if one exercises his unique strengths and virtues for a purpose greater than his own immediate goals.

Question 14.1 How can happiness be modeled using the systemic yoyo model so that we can prove the existence of principles upon which enduring happiness and success are based?

Based on what we have done so far with human mind, let us study happiness using the systemic yoyo model as follows: At a specific moment of time a person feels happy, if, and only if, his underlying yoyo field just achieved an upper hand over a resistance in its movement against some other field flows in its environment. This definition illustrates why the ultimate objective of all human efforts is about achieving happiness and conquering additional greater and more challenging difficulties, and that happiness lies always in the future and never in the past, because no matter what happened in the past, one's yoyo field is current experiencing other hardships and difficulties in its interaction with other fields in the environment. This end, in fact, is in itself a principle upon which enduring happiness is based. That is, an enduring happiness can be possibly achieved if one eyes at conquering additional difficulties in life and knows (either correctly or incorrectly) that he has the capability to do so.

Our definition of happiness does include the meaning of living a good life (when comparing with others, one feels that he does not have as much difficulty in life) or flourishing (when comparing with the fields in the environment, one's field is spinning strongly), as considered by philosophers and religious thinkers in the

history. It also contains the meaning of pleasure for felt experience(s), as how happiness is used in the daily language of our modern day. Here, living a good life and flourishing represent some more grand scale achievements of conquering difficulties than pleasures.

Question 14.2 How can we show Aristotle's statement that happiness is the only endeavor that humans pursue after for their own sake, observing that men sought wealth, honor, or health, not for their own sake but to be happy?

According to the discussion of Question 14.1, happiness is equivalent to one's momentary victory over an existing resistance in its movement against some other field flows in its environment. Here, each momentary victory is judged by using the person's $\pm$ function of his conscience. From this systemic model, what Aristotle states naturally follows, because getting an upper hand over a forever-presenting resistance in one's environment is difficult to accomplish on a regular basis. In particular, wealth, honor, and good health are among the few objects all men seek after. However, accumulating a great amount of wealth has been proven in the material world to be difficult if not impossible for the majority of the population. As for health, many people take it for granted until it is too late to truly take good care of it. In terms of honor, there is such an interesting phenomenon that great thinkers of the history tend to be recognized after they are no longer around. On the other hand, many people are very materialistic and only seek after instant gratification. This is the reason why Yi Lin observed (Lin 2008b, p. xiii) that

> … all the then-recently-published works, which I had a chance to read, belonged to the kinds of activities of patching holes and gaps existing in well-accepted theories. One piece of evidence supporting such an observation is the fact that to validate the significance of one's research, the researcher only has to relate his or her work to one of the big name of the scientific history. Some researchers even go as far as prophesying what these great minds of history would say and do if they were working on what these current researchers are doing. When it turns out to be difficult for them to relate to any of the well-known names of the past, researchers commonly publish their works in "legitimate" journals, hoping that the legitimacy of the journals helps to justify the quality of their works. … another side effect of such a trend is that more scholars spend the most valuable years of their otherwise productive careers playing scientific games instead of seeking scientific truths for the benefit and advancement of humankind.

That is, happiness is any endeavor that is difficult to pursue in the material world with successful consequence. It is an activity, as claimed by Aristotle, that is different from emotion or state, although there might be emotions and states attached along with it. Because each victory in one's field movement is closely attached to his $\pm$ function, where a pattern or interaction of flows is seen as positive or moral if it has an assigned $+$ value, this fact explains why Aristotle treats happiness as the practice of virtue.

Question 14.3 Is it theoretically possible for humans to behave both individually and collectively in order to achieve the expected resulting happiness of such behavior, as John Stuart Mill and Jeremy Bentham advocated?

According to our systemic yoyo model for human beings, we can theoretically see the possibility for humans to behave both individually and collectively. The reason is that in the most general case, each person lives in an environment within which there is at least another person. As long as there are several people in his immediate circle of livelihood, he has to interact with them, meaning that his underlying fields have to experience various interactions with the fields of these people intimately. To live a happy life, he has to strike equilibrium with these other fields, meaning that at the same time when he maintains his individuality, he has to collectively live along side with others, while occasionally scoring an upper hand here and there, now and then.

This analysis in fact implies that for any meaningful society to function properly and cohesively, all the members of the society have to live both individually and collectively together. Otherwise, the society would no longer exist meaningfully. Now, the real question becomes: How much individuality and collectivism should be allowed in a given society? For this end, please consult with Lin and Forrest (to appear a–f), where we focused on the investigation of civilizations. All the details are omitted here.

Question 14.4 Corresponding to the biological studies of happiness by using evolutionary perspective, what new insights on happiness can be obtained by using the concept of whole evolution in systems science?

The idea of whole evolution (Lin 1998a) is about looking at the development or evolution of a system from its start to its finish as a whole. So, based on our systemic modeling of happiness, the following conclusions are natural:

1. When we say that a person has a happy life, it means that throughout his life, the person experiences victorious moments one after another. Here, by victorious moments, it simply means achieving whatever he wants either big or small throughout his lifespan.
2. One way for a person to live a life of enduring happiness is to have such a definite goal that its realization is not very well defined so that he can only feel the gradual realization of the goal without any specific means to check on the progress.
3. Limiting oneself within a well defined boundary can only provide the person a temporary state of happiness, even if his field is no less powerful than any other fields within the border.

Instead of listing more results, let us now see why these conclusions hold true. For conclusion (1), from our systemic modeling of happiness, it follows that a life is lived happily, if in the person's interactions with other fields within his circle he has been regularly taking the upper hand without any major setback and/or each and every major setback has been countered with satisfactory consequences. For conclusion (2), the key is how the definite goal is defined. For instance, if a young girl grows up dreaming about becoming one of the beautiful cheer leaders for the Dallas Cowboys, the chance for her to experience disappointment and unhappiness is almost 100%. Similarly, if she dreams about singing for the Disney

World as a professor singer, the probability for her to suffer from disappointment is extremely close to 1. On the other hand, if a person desires to be good at something or owns a lot of something tangible, then the chance for him to live a happy life is much greater than the girl we just mentioned. The reason is that becoming either a cheer leader for Dallas Cowboys or a professor singer for Disney World is a very specific goal. Its realization can be easily checked by anyone. On the other hand, the desire of either being good at something or owning a lot of something tangible, such as money, is comparatively more abstract and in most cases difficult to verify because the standard of realization is not as clear-cut as in the previous situation. In particular, if a boy dreams about becoming a great inventor when he grows up, as long as he indeed invents a few useful products in his life, more or less he will be content with his achievements. Even if he compares himself with such giants as Thomas Edison, at the same time when he acknowledges the fact that he still has a long way to go, he may still feel satisfied to a degree that he indeed becomes an inventor. Now, if he not only compares himself with Thomas Edison but also aims in becoming the next Thomas Edison, his life will still be happy when compared to most other people. It is because the higher his aim is and the harder he actually works toward the materialization of the aim, the more increased intensity his field will be spinning at when compared to other fields in his environment. That is, in his daily life, he has naturally gained upper hands at frequent occasions. That is, the person lives a happier life than most other people.

Conclusion (3) holds true similarly to the situation when a society or culture decides to isolate itself from others (Lin and Forrest, to appear 4). In particular, only when one is temporarily content with his state of field motion, he would potentially limit himself within a well defined boundary, hoping that his current state of affairs or happiness would continue indefinitely, because otherwise, he would want to seek outside of the box for other available resources to help improve his status. Now, when one confines his activities within a specific circle with a well defined border, then the dishpan experiment (Hide 1953; Fultz et al. 1959) suggests that this "dish" will sooner or later experience internal turmoil. When that happens, the said person might no longer be content with his new state in comparison with others. Now, is it possible that even during the chaotic state of the "dish" the said person's field can be maintained at a level no less powerful than any other field within the imaginary "dish"? The answer to this question is No, because when he confines himself within the said circle, it does not mean that other members of his circle also decide to stay exclusively within his defined circle. In general, some other members of his defined circle would still have connections with the outside. As argued in Lin and Forrest (to appear f), open societies are more powerful than closed ones. So, in due course the fields of these people will spin more strongly and more viciously than the field of the said person. This analysis provides an argument for conclusion 3).

Question 14.5 Why is it true, according to the positive psychology, that when one exercises his unique strengths and virtues for a purpose greater than his own immediate goals, he will have a chance to experience the most profound sense of happiness?

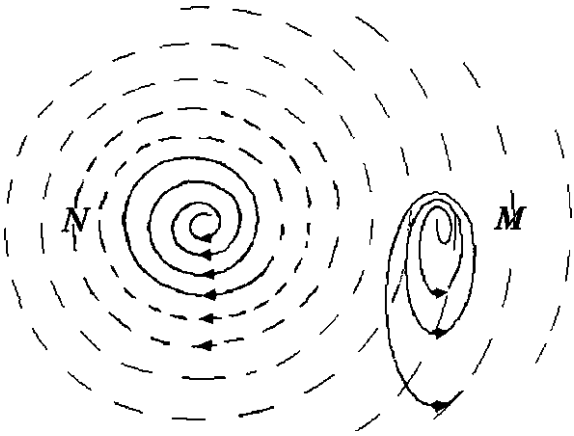

Fig. 14.1 A tiny yoyo field *M* spins within the territory of a powerful field *N*

Similar to what we have discussed earlier, when one exercises his unique strengths and virtues for a purpose greater than his own immediate goals, it implies that the person makes sure that his underlying yoyo field resonates with the greater, more powerful field of the purpose. In this case, due to the help of the strength of the greater field (Fig. 14.1, where the left-hand side of *M*'s field is greatly helped by the field of *N*), the field of the person has a chance to win more sweeping victories over some of the other fields in his environment than ever before without the presence of the field of the purpose. This end explains why he will have a chance to experience the most profound sense of happiness in his lifetime.

14.2 The Systemic Mechanism Behind Fears

Whatever one embarks on to accomplish in life, one of the first obstacles he faces and has to overcome is fear. He fears criticism, loss of love of someone, poverty, ill health, old age, death, or a combination of these six basic fears.

According to the systemic yoyo model, one's fear of criticism is a natural consequence of the constant battles between the person and all other systems in his environment. Its mechanism of appearance is similar to that of his self-awareness (Lin and Forrest, to appear e). In particular, his underlying systemic yoyo field prompts him not only to take away elements, such as goods and wares, from other spinning fields, but also to justify his action with criticism of his fellow man's character. Here, character is the person's relatively stable system of traits, consisting of his optimal patterns of field flows and field interactions, that specifies how he would relate and react to others, to stimuli, and to known field structures of the environment (Lin and Forrest, to appear f). The fear of criticism takes on many different forms, the majority of which are trivial in nature. When one does not

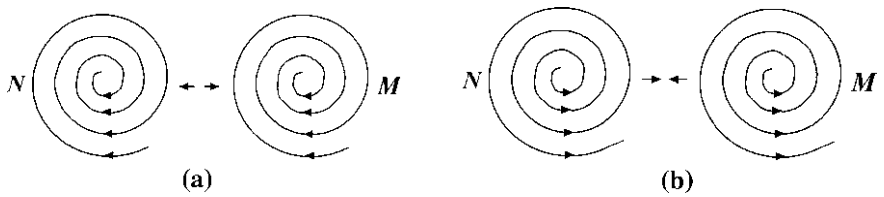

Fig. 14.2 The systemic mechanism underlying a binary star system. **a** The converging side. **b** The diverging side

conduct himself along with the majority or the "style" of the culture, he runs the risk of being ridiculed by others. So, a natural question is who establishes the "style" for the culture? Evidently, it cannot be an arbitrary member of the culture. Instead, it is the unofficial leaders of the culture who decide either consciously or unconsciously what should be considered the acceptable norm. For instance, for every season, there is the style of apparel, which is established by the powerful manufacturers of clothes. In every work place, large or small, other than the publically known company codes, there are unofficial rules of conduct. These unofficial rules are generally established by those so-called big wheels and supported and carried through by their followers.

The reason why the fear of criticism can be powerful and mighty is that each individual has to be morally responsible for the well-being or the inertia of movement of his society; otherwise this individual will be run over by other people or elements of the society mercilessly, as concluded in Lin and Forrest (to appear e) when they address the question of how individuals are morally responsible for their conducts. In particular, the "well-being" of the society stands for the maintenance of both the mental inertia and the inertia of the field motion of the society. That is, imagination helps a person to know what is considered the unofficial rules of conduct and free will prescribe why he should or should not follow the majority of the culture (Lin and Forrest, to appear e). Here, the reservoir of imagination clearly reveals what patterns of flow and interactions are currently dominating, and the ability of making at least short-term predictions foresees what could potentially happen if one takes a chosen course of action.

As for the fear of loss of love of someone, the systemic mechanism can be provided using the concept of n-nary star systems, for any natural number $n > 1$. To make our explanation more comprehensible by most of our readers, let us look at the situation of $n = 2$, a binary star system. More specifically, when two yoyo fields, which are rotating harmonically along with each other, interact with each other, Fig. 14.2, the converging sides attract each other and have the tendency to combine into one greater field (Fig. 14.2a). At the same time, when they are too close to each other, the diverging sides (Fig. 14.2b) start to repel each other so that the yoyos are pushed apart. And when they are a distance apart from each other, the converging sides begin to pull themselves toward each other. Due to the alternating effects of these attraction and repulsion forces, the two spinning yoyos

are bound to each other forming a binary star system. This same reasoning works to show the existence of n-nary star systems, for any natural number $n > 1$. Now, inside a binary or n-nary star system, the stars travel along their individual orbits in a balanced fashion around their center of mass. Now, if one of the yoyos in the star system departed or is stolen from another system, then all other yoyos of the losing system would experience loss of balance or "love" of the lost field. Such loss will naturally throw the other yoyos into an unexpected chaotic state of motion with decreased size of territory and the potential of breakage of the original equilibrium system. This foreseeable state of uncertainty and extinction of the existing system makes one fear the loss of love from that special someone. Because of this underlying mechanism, it can be seen why the fear of loss of love of someone is one of the most painful, if not the most painful, of all the six basic fears one frequently experiences.

As for the fears of poverty, ill health, old age, and death, to some degree, they are related. For poverty, it means one's inability to absorb what he needs to feed his underlying yoyo field for its basic viability. So, this fear is related to that of death. The need to acquire or the fear of poverty makes man do whatever he can; through legal methods, if possible, or through other means if necessary. That is, poverty is terrible, a source of crimes, and an unforgivable sin. That is why man fears it. For the fear of ill health, its mechanism is similar to that of poverty. With ill health, one naturally associates it with his inability to keep his underlying field viable. The fear of death to many is the worst of all the six basic fears of man. Throughout the entire human existence, the following questions are still unanswered:

Question 14.6 Where did I come from? Where am I going after death?

Before we address Question 14.6 at the level of individual persons, to some readers what are just asked may not seem scientifically serious. To make these readers recognize the significance of these questions, let us look them from a different angle. If one has read this book up to this point, he/she should have been convinced that human organizations or entities of all levels from civilizations to individuals share the same systemic yoyo structure. So, these very questions can also be asked at the height of international politics, for instance, where the individual "I" would be replaced by a human organization X, which could be "my country" or "that hostile state" or a specific "terror group". Now with a shift in the meanings of the individual "I", the questions we try to address could become something similar in nature to: Where did that terror group initially come from? Where would the followers of the extreme ideology behind the terror group go after the organization is formally destroyed? To this end, one can now clearly see the fact that meaningful and constructive answers to Question 14.6 can be employed to aid policy makers in their decision making at the international, national, regional, or personal levels.

Because no one knows where we are from at birth or where we go at death, it opens the door for the mind to be influenced or controlled by various brands of trickery, deceit, and fraud, leading to fearful illusions of crudity. To this end, as a matter of fact, our systemic yoyo model provides a quite clear explanation to these

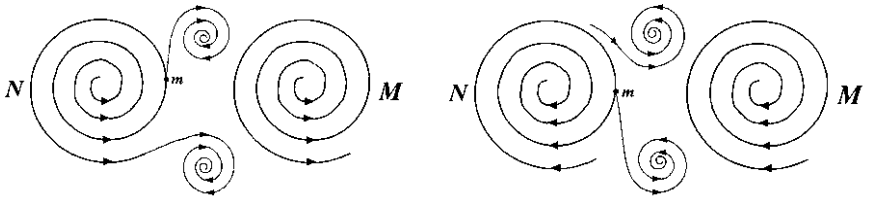

Fig. 14.3 The only potential ways subeddies can be created by parental whirlpools **a** object m is located in a diverging eddy and **b** object m is located in a converging eddy pulled or pushed by a diverging eddy M and pulled by a converging eddy M

two open questions. In particular, each person is born out one of the only two kinds of yoyo field interactions (Fig. 14.3), where the created subeddies do not have any past. In particular, in Fig. 14.3a, due to the fact that the parental fields are both diverging, particle m will be potentially trapped in the regions of the two subeddies and steady supplies of such particle m will be provided by both of the parental fields. On the other hand, because of the convergencies of the parental fields in Fig. 14.3b, the gap areas between the two fields will be occupied by particles that are balanced by the pulling forces of the parental fields. Because Fig. 14.3a and b are the opposite sides of two harmonically rotating yoyo fields, the subseddy fields in these figures are in fact the same subeddies, seen from the two opposite directions. As for where an old, deteriorating yoyo goes, our yoyo model indicates that when such a field becomes too weak, its components will simply be absorbed by other powerful, mighty fields spinning in more or less harmonic forms. That is, when a weak yoyo field disappears, it does not go anywhere except that it simply degenerates into unrelated pieces, attracted by other vigorously spinning fields.

Along with fears, there appears such a phenomenon as self-confidence. For instance, if we look around in almost any chosen setting of social hierarchy, we notice that there are only privileged a few who advance to prestigious and highly paid positions. All human hearts long for the needs of being heard, being understood, being respected, and being valued. However, only these privileged few have successfully achieved the status of power and influence. And, all others in the same social environment get painfully buried in their daily routines, even though some of these people may have gone through more professional trainings and seem to perform as much work as those privileged a few. So, a natural question at this junction is:

Question 14.7 What is making the difference here between the privileged a few who advance quickly to respected social status and highly paid positions and the rest who seem to stay still in their daily routines?

To address this question, we only need to select one representative from each group and compare them carefully to see why one advances and the other stands still. After peeling off the superficial appearances, we can quickly and quite easily come down to the core of the reason: the one who advances has self-confidence,

he believes in himself, while the other is more or less a believer of fate. The person with self-confidence backs his conviction with dynamic and aggressive actions that he shows the world that he can produce results, which nobody else in his shoes could have. What is interesting is that his self-confidence is contagious and impelling. It is persuasive and attracts others. On the other hand, the other person, who does not advance, shows various signs of indecisiveness and a lack of self-confidence, such as the look on his face, the posture of his body, the lack of briskness in his walk, the uncertainty in his speeches, etc. To this end, let us look at the following question.

Question 14.8 What is the systemic mechanism for such a difference that separates the privileged a few of any society from the rest of the mass?

As a matter of fact, the so-called self-confidence (Corsini 2001) relates to self-assuredness in one's personal judgment, ability, power, etc. That is, self-confidence is closely related to one's ability of making predictions in his free will. This ability depends on how deeply he can reach into his reservoir of imagination and how well he can combine different but relevant information into useable knowledge. This end in turn is determined by the person's level of education, as discussed in Lin and Forrest (to appear e). In particular, a person with self-confidence has a strong sense of self-awareness, which could mean that his underlying yoyo field interacts with other fields in a relatively cleaner and brisker manner. Due to the cleanness and briskness in his interactions with others, his reservoir of imagination stores relatively more clear pictures on when and how his interactions with others have resulted in advantages or disadvantages to him. So, when he faces a challenge in the three-dimensional world, his imagination can definitely pinpoint out what he should consider doing or trying in order to bring about advantageous consequences. With the cleanness in the knowledge in his imagination, his free will can relatively easily produce more accurate predictions as for what might potentially follow his various courses of action. When his various decisions (made based on his prediction ability) are confirmed to be accurate one by one over time, his ability of making adequate predictions becomes sharper and his level of self-confidence grows higher accordingly. That is, the majority of the mass who do not advance like the privileged a few may suffer from problems in either their self-awareness, or the quality of information stored in their imagination, or the ability of making predictions in their free will. However, as pointed out earlier, these problems can be remedied through education and training.

This analysis explains why most people do not pay much attention to anyone who does not have confidence in himself. In other words, he does not have the field strength to attract others, because in his constant battles with other fields, it is difficult for anyone to know if he is ahead in any interactional contact. It means that his yoyo field does not have enough strength to pull other fields closer to itself. To this end, we have the following natural question.

Question 14.9 Is there a definite method through which self-confidence can be developed in any person of average intelligence?

Based on our analysis in the previous paragraphs, the answer to this question is both yes and no, depending on where the lack of self-confidence is originated. In particular, if a person's lack of self-confidence is solely caused by his strength of self-awareness, then he can be placed in an educational program in which his underlying yoyo field will be made more uneven than before. This newly acquired unevenness in his internal structure will make his field rotate more vigorously so that his suddenly increased field strength will produce some of his needed advances due to the inertia of motion other fields experience [the First Law on State of Motion (Lin 2007)]. These advances will add to the reservoir of his imagination and lead to more confident predictions out of his free will. Second, if the person's lack of self-confidence is caused by the quality of information stored in his imagination, then it will be difficult for the person to acquire self-confidence, because the root problem can be some of his bodily deficiency. However, if his lack of self-confidence is caused by his inability to reach into his reservoir of imagination, then he can acquire his necessary self-confidence through specially design educational program so that his capability of tapping into his imagination can be enhanced. Third, if the person's lack of self-confidence germinates within his free will, where he could not make adequate predictions, then once again he can potentially acquire his self-confidence through any means of making his internal structure uneven. It is because with an uneven internal structure, he will experience more victorious moments in his interactions with others. These treasured moments will help him to organize relevant information in his imagination and to make at least short-term predictions in his free will. Our analysis developed in this series of work can be employed to validate the following:

The Law of Mental Telepathy (Hill 1928, p. 131). Any thought is communicated from one mind to another without the need of using human sense organs through signs, symbols, or sound.

The term telepathy is created by coining the Greek word $\tau\eta\lambda\varepsilon$ (*tele*), meaning "distant," and $\pi\acute{\alpha}\theta\varepsilon\iota\alpha$ (*patheia*), meaning "to be affected by." It describes the purported transfer of information on thoughts or feelings between individuals by means other than the five classical senses. This term was initially created in 1882 by the classical scholar Fredric W. H. Myers, a founder of the Society for Psychical Research (Carroll 2005). Any person who is able to make use of telepathy is said to be able to read the minds of others. Telepathy, along with psychokinesis, forms the main branches of parapsychological research, and many studies seeking to detect and understand telepathy have been done within the field.

According to Lin and Forrest (to appear 3), each thought stands for a local eddy pool in the reservoir of someone's imagination; it is triggered by some hint from the outside world and formed through a thinking process, through which the external trigger generates the local eddy by pulling relevant information and knowledge together to form an organic whole, called thought. Now, imagine that two people live side by side (Fig. 14.4), seen as two spinning yoyos whose fields extend infinitely into the space and onto and over each other. When a local eddy pool is formed within one of the fields, the other field has to experience the change

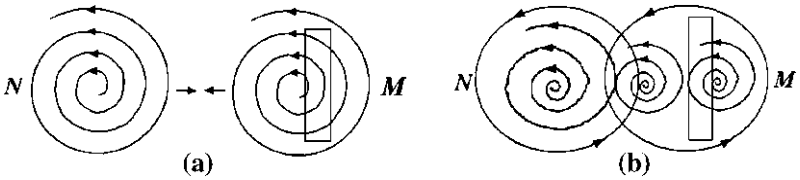

Fig. 14.4 Interaction between two spinning fields. **a** Original balance interaction between *N* and *M*. **b** Affected *N* field due to a split in *M*

in the other field. In particular, the originally balanced interaction between the fields *N* and *M* (Fig. 14.4a) is interrupted by an external force so that the uniform rotating field of *M* is now split into two harmonic local eddies (thoughts) (Fig. 14.4b). With the change in *M*, some flow patterns within *N*, such as those of field *N* flowing through the rectangular area in Fig. 14.4a, now have to face resistance from the subeddies in *M*, see the rectangular area in Fig. 14.4b. Before the split in *M*, these flow patterns could have been assisted by the field of *M*. However, after *M* underwent a change, these flow patterns have to fight against the subeddy located on the right hand side.

This analysis of course implies that the change in *M* has to be significant enough for *N* to experience adversities from *M*. However, because bodily vibes are realization of the underlying yoyo field in the three-dimensional space, as long as a new form of movement in the underlying field of *M* is well formed, the field of *N* will sense it through its field interactions with *M*.

Our discussion here implies why when one believes in himself, others will potentially believe in him too. They will turn in on his thoughts and feel toward him just as he feels toward himself. This end can surely be seen as a manifestation of the Law of Mental Telepathy. Opposite to this end, if one fixes in his mind that his ability is limited, meaning that he believes that his underlying yoyo field cannot win the fight against all the mightier fields in his neighborhood, then his self-awareness will no longer pick up the opposite information available from the environment. So, no longer any local eddy will be formed within his imagination in order for him to challenge the mightier fields. Without such local eddies formed, his ability to predict out of his free will will no longer work toward this end, either. That is, his belief turns out to be a self-fulfilling prophecy.

14.3 The Value of Forced Struggle

Let us now imagine a spinning yoyo, which is not acted upon forcefully by any other field from the environment. From the First Law on State of Motion (Lin 2007), it follows that this specific yoyo will stay in its current inertial state of motion for the rest of its life. This imagined yoyo does not have to be situated in isolation from other rotating fields. As a matter of fact, in most realistic scenarios,

a person can and do grow into such a powerful stage that it has balanced all interactions he ever had with others. So, as long as no major change occurs, that person will continue his inertial state of motion until his very end of life. In this case, if the person does not reach out to new territories, its underlying spinning field will not have any chance to experience any unknown imbalance within its internal structure. It will lead to a pre-mature atrophy and in turn an early loss of ambition and self-confidence. Without these essentials, any person will be carried through life on the wings on uncertainty, caused by the interactions of other fields. Therefore, far from being a disadvantage, any forced struggle in life is a decided advantage. It is because through struggles, one further develops these essential qualities, which, otherwise, would forever lie dormant without being bullied. For instance, many great figures in the history found their places in the world because of having been forced to struggle for their very own existence early in life.

In comparison, forced idleness is far worse than forced labor, because forced idleness is equivalent to a person being pressured to possess an even field structure by outside forces. That naturally leads to less desire, for the person's underlying yoyo to spin on his own, or less ambition for the person. On the contrary, being forced to work hard and forced to do one's best breed in his temperance, self control, strength of will, content, and other countless virtues that the idle will never know.

Now, we have the following natural question:

Question 14.10 What is the systemic mechanism for why any forced struggle in life is a decided advantage?

As what has been shown in Lin and Forrest (to appear 1), one's ambition is the self-determined rotation strength of his underlying spin field; and his self-confidence, see Sect. 14.2 in Lin and Forrest (to appear 5), is closely related to his ability of making predictions in his free will, which traces all the way back to his level of self-awareness. Here, the more uneven his yoyo structure is, the higher degree of self-awareness is, and the stronger self-confidence will be. That is, both ambition and self-confidence are fundamentally determined by the degree of unevenness in the internal structure of the person. Similar to what has been discussed in Lin and Forrest (to appear 4), there are two ways for a field that spins in its inertial state to suddenly acquire the momentum to rotate at a higher level of intensity: (1) a new unevenness in the structure of the field suddenly appears; or (2) an ever-presenting field of the environment suddenly, unexpectedly disappears. Now, any forced struggle in life is equivalent to the second situation where an ever-presenting field of the environment suddenly, unexpectedly disappears so that one has to fill the vacuum left behind by the departed field. This end explains why any forced struggle in life is a decided advantage.

What is more interesting is that when a person quits struggling to meet his ends for whatever reason, he will eventually drift into such a frame of mind that he will actually look with more or less contempt upon those others who are still forced to carry on. This end, combined with the First Law on State of Motion, in fact implies that if one desires to get more in his life, he will have to demand more of himself instead of any other person. It is because all others will still be moving in their

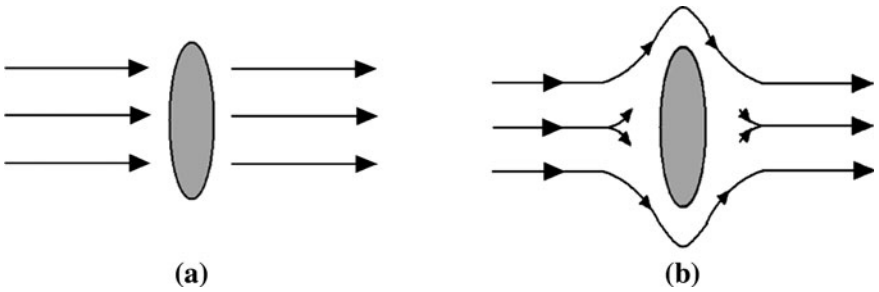

Fig. 14.5 The appearance of a local stoppage and how it can possibly be overcome. **a** A blockage appears in a flow field. **b**A possible new pattern of flow appears

individual inertial state of motion. If the person indeed tries to demand from others, then he will have to face two possibilities: (1) his demand cannot be met due to the inability of others because they are still moving in their original states of motion; or (2) he will be pulled back down from realizing his desire by others.

This analysis indicates that in general adversities and temporary defeat are blessings in one's growth. It is because each adversity and each temporary defeat stand for the realizations in the three-dimensional space of a disadvantageous flow pattern and a temporary stoppage in the underlying field movement. Such disadvantageous flow pattern and stoppage form a trigger for the mind to form local eddy pools in the reservoir of imagination. By making use the imagination, conscience, and free will, the person makes a consciously better fight against the other resisting fields that have created the disadvantageous flow pattern or temporary defeat. That process, when repeated several times, helps the person become better at what he does, leading eventually to the realization of the objective of his aims. This end provides an explanation for the following:

Question 14.11 Why cannot any person who exercises complete self control be permanently defeated, as claimed by Hill (1928, p. 187)?

In particular, when a person exercises complete self control, he has a complete grip over his own thoughts, see Lin and Forrest (to appear 3) for more details, where it is shown that each thought is a local eddy pool in the reservoir of imagination. That is, any person who has a complete grip over his own thoughts possesses such an ability that he can maneuver over the form and movement of his thought pools in his imagination. When he experiences a defeat, a stoppage of some local flow in his underlying field appears due to an external force. If the defeat is permanent, it means that the stoppage of the regional flow will forever exist in the overall field of the person's underlying yoyo structure. Figure 14.5a shows how a blockage appears in an originally uniform field of the imagination due to external forces. If the person has the ability to maneuver over the form and movement of his thought pools in his imagination, then instead of a permanent stoppage of the regional flow, a new pattern of flow as shown in Fig. 14.5b might

appear. Now, if the internal yoyo structure of the person is extremely uneven, then the person's field will be rotating on its own with a high level of intensity. It means that the blockage as shown in Fig. 14.5a might not create any trouble for the person at all, because his originally uniform field may simply push the blockage along without any need to alter its pattern of flow as shown in Fig. 14.5b. This is a systemic analysis that explains why any person who exercises complete self control cannot be permanently defeated and provides a figurative illustration on how obstacles and opposition have a way of melting away when confronted by the determined mind that is guided to a definite end with complete self control. Considering the field from the environment that exerts the external force and creates a blockage for our specifically concerned yoyo field, we naturally have the following question.

Question 14.12 Do enemies always exist? Other than their annoyances, are enemies important to have?

To address this question well, let us first look at the concept of enemies. When addressing the conflicts between civilizations and cultures, Lin and Forrest (to appear c) studied how enemies of a people are defined and why people need enemies in their identity search. Based on our systemic yoyo model of each human being developed in Lin and Forrest (to appear 1–5), we can adopt what is established in Lin and Forrest (to appear c) for our purpose here. In particular, for each human being, his underlying spinning yoyo field is characterized by its stirring (or rotational) momentum (m) and the stirring (or rotational) kinetic energy (m^2), comparing to the traditional irrotational momentum (mv) and the irrotational kinetic energy (mv^2), created by the angular speed of the rotational stir of the material m's structures existing in a curvature (non-Euclidean) space. With some ingenious mathematical manipulations, it is shown (Lin and Forrest, to appear c) that the concepts of linear speed and angular speed have different physical meanings and that a conservation of stirring energy not only contains the conservation of linear speed kinetic energy, but also shows the way and procedure of the kinetic energy's transformation and transfer.

It is empirically (OuYang 1998) and theoretically (Lin and Forrest, to appear c) shown that

1. The quasi-stable existence of natural materials is caused by the conservation of the quasi-three-ringed stirring energy, where the middle level circulations hold huge amounts of energy;
2. Three-leveled circulations, shown in each energy transformation, have played the role of coordinating and restraining the energy transformation for the underlying stable existence;
3. The destructive nature of non-three-leveled circulations leads to instable evolutions; and
4. The dynamic equilibrium that without eddy motions there will be no kinetic energy transformation and the amount of kinetic energy determines the internal heat of the eddy motions.

Because between two arbitrary spinning fields, there does not exist any eternal friendship other than common interests and constant conflicts. So, nobody can reasonably use conflicts or common interests as his basis for identifying enemies. To define enemies, one only needs to single out those out there who seemingly attempt to destroy the temporarily stable three-ringed circulation structure existing in his yoyo spin field, because this three-ringed circulation structure is the guarantee for the stable existence of the person himself. When a person is aware of his own existence, he in fact identifies himself with the existing three-ringed stable circulation structure in his underlying yoyo structure. However, in terms of the whole evolution of his yoyo structure, any stability in his yoyo structure can exist only temporarily with change being the absolute. So, when the person can finally identify himself with a relatively stable field structure and feel proud of his possession of that entity, he is keen about those who might potentially damage or seem trying to destroy his identified entity.

Now, the duality of yoyo fields, the existence of yoyo fields appears in pairs, each of which consists of two fields spinning in opposite directions, explains why enemies always exist. They are the fields spinning in opposite directions. Because of their opposite spinning directions, these fields always create resistance and difficulties to these duals. It is also because of this reason, enemies are the ones who discover one's weaknesses and various temporary defeats and point them out to him. Their constant reminders of one's shortcomings in fact make these enemies very important for him in order to keep him on track.

The basic idea behind forced struggle in life is that the greater the change forcefully demanded on a person, the more difficult challenges the person has to deal with, and the more relevant as for how the person can reply on his self-awareness, reach deep into his reservoir of imagination, call on the $\pm$ function in his conscience, and make adequate predictions in his free will become. In particular, any great inescapable demand from the external world simply means the appearance of a change in the inter-field interactions. To reach a new state of equilibrium in his normal field operation, one has to reply on his self-awareness to pick up all the new patterns of flow and interaction, form different pools of thought in his reservoir of imagination, pick out those viable choices of thought by making use of his $\pm$ function in his conscience. Among all the available choices of thought, he will need to make predictions on the potential consequences for each of the choices so that the suitable choice of action with the most desirable will be finally decided on. To minimize potential damage to his underlying yoyo structure, one has to reach the most suitable choice of action as quickly as possible. This analysis explains why for successfully handling a changing environment in our modern times it is simply not enough for one to go in earlier, stay later, be more efficient, and live with sacrifice for now. As a matter of fact, the truth is that both balance and peace in life are produced or materialized in the three-dimensional space by a healthy, vigorously spinning yoyo field. The health and shape of the spinning field are determined by a clear sense of priorities and by how these priorities are followed.

Opposite to the concept of enemies, let us now conclude this section by looking at the law of attraction.

The law of attraction (Hill 1928, p. 141) In terms of humans, like attracts like. That is, to learn what one is, just study those he is with most of the time.

According to the systemic yoyo model, considering how human beings live side-by-side of each other, the reason why this law holds true in general is because only when one's underlying field spins harmonically with another field, as shown in Fig. 14.5, these two fields will attract to each other. In all other possible interactions of fields spinning side-by-side, the fields do not tend to combine. Through the operation of this law of attraction and that of mental telepathy, we can now see why those who desire more in life and actually take actions towards the realization of their objectives are constantly attracting trouble, grief, hatred, and opposition from others.

14.4 The Systemic Yoyo Structure of the Mind

Based on our previous analysis in Lin and Forrest (to appear 1–5) and in this chapter, it can be seen that for materializing the ultimate goal of happiness, one needs to acquire the necessary characters, to think accurately, and to develop a strong and burning desire for accomplishing high levels of achievements with the needed enthusiasm or self-confidence. To this end, one has to cultivate all of his four human endowments, self-awareness, imagination, conscience, and free will by utilizing varieties of thoughts and inspiring stimuli.

The mind indeed functions on the basis of its systemic yoyo structure. That is why it is like a magnet that it can attract useful ideas from all sources, see Lin (2009) for how magnets and yoyo structures are connected. Because a person's acts are always in harmony with the dominating thoughts of his mind, as analyzed in Sect. 14.3 of Lin and Forrest (to appear 3), any predetermined definite goal that is deliberately fixed in the mind and held there with the determination to realize it will eventually saturate the entire self-conscious mind until it automatically influences the necessary physical action of the body toward materializing that goal. It is through the aid of this very principle that many historical figures and current world leaders reached their high statures. For example, Napoleon lifted himself up from the low station of poverty stricken Corsican to the dictatorship of France; Thomas Edison rose from the lowly beginning of a news butcher to where he was accepted as a leading inventor of the world; Abraham Lincoln bridged the mighty chasm between his lowly birth in a log cabin in the mountains of Kentucky and the presidency of the greatest nation on earth; Theodore Roosevelt became one of the most aggressive leaders that ever reached the presidency of the United States.

The spinning yoyo field of each human being exists along side with many other yoyo fields rotating at different speeds with different orientations and occupying territories of various sizes. It is like a little boat floating in a rough sea of eddy pools. That explains why when one establishes and tries to attain his definite goal

or purpose in life, he needs to be careful that his goal or purpose has to be constructive and his eventual attainment of the goal will not bring hardship and misery to anyone. Here, by constructive, it means that it does not constitute a damaging force that destroys some other spinning yoyos in its neighborhood. From our systemic yoyo analysis, it can be seen that however a yoyo spins, it has to create conflicts with each and every spinning yoyos it comes in contact with. So, by not bringing hardship and misery to anyone, it really means not to affect the very existence of other spinning yoyos in the neighborhood.

Because the human mind also possesses the systemic yoyo structure, along with its various interactions with other like minds (yoyos spinning in the same fashion) and different minds (yoyos spinning in different ways, such as in different directions or different in terms of divergence and convergence), one surely and inevitably has to experience self-doubt or skepticism about his definite goal and the potential of his eventual attainment. When facing spinning fields flowing in the opposite direction, especially if some of these opposite spinning fields are powerful, he might very well question whether or not his own ability and strength could conquer the adversities. If any of the skepticism, either directly from the environment or within himself caused indirectly by factors of the environment, slows or completely stops his self-development, he will have to start his journey to success overall, if he can stand back up again from the previous failure or defeat. This end explains why skepticism has been known as the deadly enemy of progress and self-development (Hill 1928 p. 65), and why the development of self-confidence and enthusiasm starts with the elimination of different forms of fear, which are experienced when one initially comes encounter with yoyo structures (or minds) spinning in different directions with varied strengths.

From the way of how sub-yoyos are created in areas under the complete control between at least two parental yoyos (Fig. 14.6), it can be seen that the most important part of man's makeup comes through physical and social heredities. The term "social hereditary" refers to as how one generation imposes upon the minds of the generation under its immediate control the superstitions, beliefs, values, legends, and ideas, which the earlier generation has inherited from the generation preceding. Social hereditary includes all sources existing in the environment and personal experiences gained from interaction with the environment through which a person acquires knowledge, thoughts, and inspirations. Clinical evidence has vividly shown that just as how genetic traits are physically passed on from one generation to another, the basic structures of the mind are also passed down through generations due to the operation of the law of social hereditary (Hendrix 2001). For example, anyone, who has the control of the mind of a child, may through intense teaching implant in that child's mind any idea whether false or true in such a manner that the child accepts it as truth and that the idea becomes as much a part of the child as the his personality, as any cell or organ of his physical body, and just as hard to change as his very nature (Hill 1928, p. 66).

As is known, habit is a powerful physical and mental trend that unconsciously determines what a person does and thinks under normal conditions. Habit grows out of the interaction with the environment, out of doing the same thing, thinking

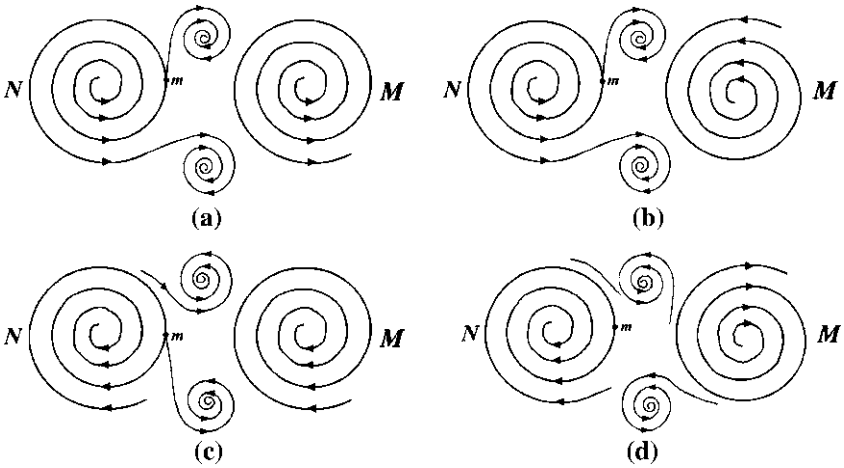

Fig. 14.6 How sub-yoyos are created. **a** Object *m* is located in a diverging eddy pulled or pushed by a diverging eddy *M*. **b** Object *m* is located in a diverging eddy and pulled by a converging eddy *M*. **c** Object *m* is located in a converging eddy and pulled by a converging eddy *M*. **d** Object *m* is located in a converging eddy pushed or pulled by a diverging eddy *M*

the same thoughts, and repeating the same work over and over again. Habit is created by repeatedly directing one or more of the five senses, seeing, hearing, smelling, tasting, and feeling, in a given direction. In terms of our systemic yoyo model, it actually implies that and explains why since the very first moment of time when a yoyo spins independently on its own, it has been continuing its rotation in a predetermined direction and orientation unless a mightier external spinning yoyo forcefully alters its original state of motion (habit). For a yoyo to spin powerfully and to attract other yoyo structures to spin along side with itself, meaning for one to succeed magnificently, it has to be able to attract enough materials (knowledge, materials, resources, etc.) into its whirlpool of attraction. Because money in the material world is a symbol in many people's eyes of ability, power, and success, this end explains why Napoleon Hill (1928, p. 87) emphasizes on the habit of saving money no matter how small amount it can be. It is because such a habit is one of the few visible indications of the internal structure of underlying spinning yoyo of the person.

If the mind is seen as a spinning yoyo, then its spin field consists of various local pools, similar to what is shown in the dishpan experiments (Hide 1953; Fultz et al. 1959), each of which stands for a habit, a motion unconsciously repeated. That is why once a habit (a local eddy pool) is formed in the mind, it will automatically expel one to think of a same thought or to repeat a same behavior.

The yoyo structure of the mind verifies the fact that the conscious mind records messages sent to it through self-suggestions or external suggestions. When one message is repeatedly sent and received, sooner or later through natural means the conscious mind translates the suggestion into its physical form. This end explains

why when one individual yoyo experiences a fast current in the ocean of spinning yoyos, it is not enough for it to simply strengthen its own rotation in order to fight off the impact of the strong current; instead, it also needs to adjust its own orientation and to harmonize itself with the other yoyos in the currents. Speaking in the ordinarily language, it means that with the dizzying rate of change in technology and increasing competition driven by the globalization of the markets, other than working hard, one must also be educated, be constantly reeducated, and constantly reinvent himself.

Through social hereditary, each person as a spinning yoyo possesses many mental paradigms on how other yoyos, representing individual persons or peoples, various parts of the world, and the world as a whole, should and would behave. These paradigms can be classified into two categories: paradigms of the way things are, or realities, and paradigms of the way things should be, or values. One interprets everything he experiences through these mental paradigms. He seldom questions the accuracy of his paradigms; he is usually even unaware the existence of these paradigms within himself. Most people believe what they see is what things are or what things should be. Their attitudes and consequent behaviors grow out of this belief. As a matter of fact, our yoyo model suggests that how one rotates as an abstract spinning yoyo determines how he sees things; and how he sees things is the source of the way he thinks and the way he acts. This end explains why two people, as two yoyos with differences in their spinning directions, speeds, or orientations, can see the same thing, disagree, and yet both are right. To this end, see Covey (1989, pp. 25–26, 28) for the great perception demonstration of young-and-old lady there. In this demonstration, even after we know that two different points of view are possible and both are correct, when we looked away and then back, most of us would immediately see the image we had been conditioned to see in the initial 10 s period of time. This fact shows how powerful initial conditioning affects our perceptions and our paradigms. If 10 s can have that kind of impact on the way we see things, what about the conditioning of a lifetime? This demonstration in fact shows that if a spinning yoyo rarely experiences any hardship, meaning encounters of yoyos rotating in different directions with different orientations, during its time of growth, after it becomes independent this yoyo will have to readjust himself and his yoyo field or he will live a difficult life.

Because each viable yoyo spins in its own way, it explains why different people have different paradigms that affect the way people interact with each other. Their different ways of rotation make them see things differently, but all from their clear and objective points of view. So, this analysis indicates that there is really no need for anyone to believe that he sees things as they are and he is objective, because that is simply not the case. This end agrees very well with the Heisenberg's principle of uncertainty (Wu and Lin 2002, p. 158), where when I measure an object, the object is affected by me; when an object is used in the measurement of another object, these two objects cannot be really separated from each other. In other words, one sees the world not as it is, but as he is or as how he is conditioned to see it. When one verbally describes what he sees, he in effect describes himself, his perceptions, and his paradigms (for clinical evidence, see

Hendrix 2001). When two clearheaded people disagree with each other, we now know based on our systemic yoyo model analysis that instead of anything wrong with at least one of them, each of them represents a different spinning yoyo. Of course, this end does not mean that there is no longer any fact to talk about. It in fact only explains that each person's interpretation of facts represents his current state of motion, as an abstract yoyo, that is predetermined at least partially by the past experience or the inertia of the state of motion, and the facts have no meaning, whatsoever, apart from the interpretation.

In daily lives, mental paradigms are the sources of one's attitudes and behaviors, and ultimately how he interacts with others. Through interactions between the underlying yoyo structures, mental paradigms of an individual person can be altered based on newly found patterns of motion. Each paradigm shift moves the person from one way of seeing the world to another. And each shift in paradigms creates powerful change in the very pattern of motion of his internal yoyo structure. Because of this, many people experience a fundamental shift in thinking when they face a life-threatening crisis that in general provides a sudden and rare chance for them to peek into their very own patterns of motion.

So, mental paradigms are important and powerful. Through them, as a lens, one sees other spinning yoyos, be they human beings, physical objects, abstract entities, parts of the world, or the world as a whole. Changes in a paradigm can be either sudden or a slow and deliberate process. Because each change in paradigms stands for an alteration in the pattern of motion of the underlying yoyo structure, sudden changes have to be caused by dramatic events, such as a life-threatening experience; and slow and deliberate changes in general are consequences of one's own desire for achieving a definite purpose.

14.5 The Human Nature

As what is analyzed above, the nature of each human being can be well described by using its underlying multi-dimensional yoyo structure. It contains an ever-changing pattern of motion. As suggested by the dishpan experiment (Hide 1959; Fultz et al. 1959), the spin field of the yoyo structure is made up of different local eddies in different numbers as a function of time.

If one wants to make relatively minor changes in life, he can appropriately focus on his attitudes and behaviors toward others (other yoyo structures) so that in his dealing with others, he may very likely produce the instantaneous outcomes he likes. However, if he wants to make a significant, quantum change, he will have to work on his basic paradigms, because only changes in the pattern of his underlying yoyo's motion can potentially alter his existing paradigms. He can only achieve quantum improvements in his life if he gets to work on the root, the basic pattern of his yoyo's motion, instead of hacking on his attitude and behavior toward others. It is because from the basic pattern of his yoyo's motion, his attitudes and behaviors are realized in the three-dimensional space.

Each yoyo structure has to follow certain rules or principles to be visibly or conceptually viable, such as that each yoyo has to spin otherwise it will cease to exist, and that for the intensity of the meridian field to strengthen, the intensity of the eddy field has to be strengthened, too. This fact indicates that there are principles that govern personal and professional success no matter how success is defined individually. Although these governing principles will have to be different for one definition of success to another in terms of their interpretations specific to the individual circumstances involved in the definitions of success, their systemic forms will stay the same, because each individual person and every social organization share the same fundamental systemic structure, the spinning yoyo structure. So, these governing principles represent laws of nature, just as those laws of physics, and cannot be broken. Otherwise, one will only break himself against the laws.

While individuals look at their own lives and interactions with others, the consequential records of what happened, in terms of their paradigms produced out of their prior experiences and initial conditionings, these paradigms are not the true picture as for how each of the underlying yoyos holds up viably and interact peacefully or violently with each other. They are only a subjective reality and merely an attempt to describe the true picture. The objective reality is composed of the natural laws that govern human growth and happiness and the operations of the underlying yoyo structures that are woven into the fabric of every society throughout history and comprise the foundation of each and every family and institution that has endured and prospered.

The existence of such natural laws can be vividly seen empirically from the cycles of the recorded history even though it is not very long and theoretically from the works in Lin and Forrest (to appear a–f). These natural laws have historically surfaced time and again. And the degree to which people in a society recognize and live in harmony with these laws moves toward either survival and stability or disintegration and destruction. These natural laws are a part of every major enduring civilization and enduring social philosophies and ethical systems. For more details, see Lin and Forrest (to appear a–f).

Based on the systemic yoyo model of each general system, including individual human beings, we can see the following so-called principle of potential (Covey 1989, p. 34): Each person is embryonic and can grow and develop and release more and more potential, and develop more and more talents, as long as the underlying yoyo structure spins viably and energetically in increasing intensities.

In all forms of life, there are sequential stages of growth and development, where each phenomenon of life is seen as a multi-dimensional spinning yoyo; it is born out of the interaction of two large scale spinning yoyos. As the rotational strengths of the parental yoyo structures gradually deteriorate, the subeddy becomes full-grown and starts to interact with other spinning pools with its matured strength. This kind of sequential stages of growth holds true in all phases of life and in all areas of development. It is true with individuals, with families, and with organizations. For example, each civilization, as a human organization of the largest scale, arises as a response to challenges and then goes through a period

of growth involving increasing control over its environment produced by a creative minority, followed by a time of troubles, the rise of a universal state, and then disintegration (Toynbe 1934–1961, p. 569ff).

From our systemic yoyo model analysis, it can be seen that for one to survive the intense competition of various relationships, he has to be a person centered on the natural laws that govern the basic operations of spinning yoyos. For him to be successful in achieving a leadership position in the flow of eddy pools in the ocean of all yoyos of the universe he must comply with the laws that govern growth, development, and success; he must focus on shaping and reshaping himself, be ready to alter his paradigms, perfect his character, and adjust his specific route of achieving his definite goal. This end is the inside-out approach as named by Covey (1989, p. 43). It says that in order to achieve success in the material world, one has to first win victories over himself and then victories with others. Our systemic yoyo model verifies the validity of this approach, because without first making one's own underlying yoyo structure viable, any success with others will only be temporary and short lived. More specifically, only after one can make and keep promises to himself successfully, he is able to make and keep promises to others; and, only after one improves himself, he has a chance to improve relationships with others.

From the yoyo model description of growth and development, an incremental, sequential, and highly integrated approach to the development of personal and interpersonal effectiveness emerges. By following this approach, one moves progressively on the maturity continuum from dependence to independence to interdependence. When one is dependent, his paradigm is all about you—the parental yoyos: you take care of me; you come through for me; if you did not come through, I would blame you for the results. When one becomes independent, his paradigm is all about I: I can do it; I am responsible; I am self-reliant; and I can choose. When one matures into interdependence, his paradigm is all about we: we can do it; we can cooperate; we can combine our talents and abilities and create something greater together. That is, dependent eddies need others to maintain their rotational momentum. Independent yoyos can get what they want through their own deliberate forms of motion. Interdependent spinning pools combine their own rotational fields with the effects of other fields to achieve their greatest success (Covey 1989, p. 49).

One outstanding characteristic of independence is that it empowers one to take initiatives and to take actions rather than be completely acted upon passively. So, independence is a liberating stage of growth and development, where the well-being of one eddy structure no longer depends on circumstances and other yoyo structures. However, because of the duality of yoyos, meaning that spinning yoyos have to appear in pairs, independence alone is not suited to achieve success in the interdependent reality of the ocean of yoyos. Speaking in the ordinary language, independence without any maturity for the slightest interdependence with others can at most produce good individual workers, where no leader or team player can appear.

Judging from how the ocean of yoyos of the universe goes through its highs and lows, it can be readily seen that interdependence is a far more realistic, advanced

concept than that of independence. If one is physically interdependent, he is self-reliant and capable of taking actions. At the same time, he realizes that by working together with others he can accomplish far more than, even at his best, he could accomplish alone. That is because when one yoyo structure combines its motion with those of other yoyos spinning in similar fashions, an *n*-nary yoyo system is formed (Lin 2007), occupying a greater territory, possessing many times multiplied strength of attraction and repulsion, and achieving greater internal equilibrium than any of the component yoyo structures could ever accomplish. In particular, if one yoyo is interdependent with others, it plays an important role of balancing the *n*-nary yoyo system and at the same time it realizes the roles other component yoyos play. For example, if one is emotionally interdependent, he derives a great sense of worth within himself, and he also recognizes the need for love, for giving, and for receiving love from others. If one is intellectually interdependent, he realizes that he needs the best thinking of other people to join with his own.

In terms of the systemic yoyo model, the state of interdependence can only be reached by an independent yoyo structure, because interdependence stands for mutually depending on each other. Dependent yoyos do not have the internal structural strength to withstand the mutually competitive and mutually beneficial interactions. In terms of humans, dependent people do not have the necessary character to be interdependent; they do not own enough of themselves. In other words, they do not have enough internal strength and self-confidence to confront with external pressures interdependent relationship entails.

To reach the ultimate state of happiness, one has first to be efficient in handling personal affairs and effective in dealing with relationships. That is, he has to rely on the natural laws that govern how systemic yoyos operate and the laws that govern the attainment of success. Only these laws working properly can bring the maximum long-term beneficial results possible. They become the basis of a person's character, creating an empowering center of adequate paradigms from which an individual can effectively solve problems, realize the existence of abundant opportunities, and be able to maximize the return of these opportunities. In doing so, the person will walk along the upward spiral path of growth of his underlying yoyo structure while enriching his systemic being by learning and integrating more detailed natural laws.

As pointed out by Covey (1989, p. 54), the effectiveness of each systemic human being lies in the balance of what is produced and the producing asset or capability to produce, known as the principle of P/PC. That is, the effectiveness is the consequence of an organic equilibrium be the P (= the production of desired results) and the PC (= the production capability). Out of human assets, one can readily obtain the desirable physical and financial assets. That is, of the three kinds of assets: physical, financial, and human, the human assets are the determining factor for the attainment of all three. The underlying reason why the principle of P/PC brings forward effectiveness is because with a healthy, viable yoyo structure, the big-bang side of the structure will have enough power and strength to give out what is wanted; on the other hand, the ability for a yoyo structure to emit materials

out of its big-bang side for the long term, it implies that the spinning yoyo has to be kept in a healthy and viable state. For example, individually, each person's most important financial asset is his capacity to earn. If he did not constantly invest in improving his own PC, he would severely limit his options to earn financially; and he would be inevitably locked into his present situation.

As a systemic human being, as one lives his values, his sense of identity, integrity, control, and inner-directedness will infuse him with both exhilaration and peace. He will be able to define himself from within, rather than by other people's opinions or by comparisons to others. As life has repeatedly shown, as one cares less about what others think of him, he will be able to know more of and understand more about what others think of themselves and their worlds, including how they like to relate to you. To understanding this end theoretically, let us focus on one specific yoyo structure M. If M is overwhelmingly concerned with and troubled by how the spin fields of other yoyos traverse through its own territory, it would be too busy at adjusting itself to handle each and every conceivable conflict within his territory. However, if M can spare itself from adjusting itself to meet the need of other yoyos' penetrating spin fields by complying with the natural laws that govern how systemic yoyo structures should operate, it will have the chance to look over how other yoyos deal with each other's penetrating fields, including M's own field that penetrates in the territory of each and every of these other yoyos.

As of the end of this chapter, we have concluded our investigation on the systemic human being, as presented collectively in this and previous chapters. Just like what has been pointed out at different places, the results of this series of research can be practically employed to produce tangible economic benefits. For instance, we concluded among other results that for a person to have self-determination and ambition, he has to have an uneven internal structure in his underlying yoyo field. To materialistically accomplish this end, a person who do not naturally have any self-determination and ambition needs to be placed in an environment through which he will experience highs and lows so that his relatively stable international yoyo structure will be reorganized unevenly. At the same time, this experience does not have to seem painful to any party, be it the person, the parents, the educator, etc., involved in the process. As for how to practically achieve this end, it is awaiting future investigation.

At the end of this volume, we like to thank you for studying our theory, the end of which might seem somehow evolving faster than earlier chapters. It is because many of the earlier conclusions are employed directly as known facts in the later chapters without additional repetitious explanations. Also, you might have found that some of our conclusions were shown to be incorrect in the existing literature. However, based on our theory, which is developed on the time tested and honored foundation of analytic analysis, laboratory experiments, and formal logic reasoning, they are correct and meaningful. On the contrary, many of the conclusions in the existing literature were not derived in such a scientifically more rigorous fashion. Also, historically speaking, contradictory findings and beliefs have permeated the scientific history since antiquity; and time and only time can eventually tell which sides of the contradictory pairs of findings and beliefs are the true

reflections of the reality. And, sometimes, none of them are entirely right, just as what is shown in Chap. 1.

Considering the fact that the aim of our work here is to unearth some of the fundamental laws of nature that can be equally employed to investigate natural and social sciences, see the first paragraph of Preface, the reader together with us can truthfully say that this aim has been more than adequately materialized. In particular, the laws on state of motion, as provided in Sect. 4.3, have been successfully applied to address many open problems in natural science, economics, finance, history, foundations of mathematics, civil engineering, and prediction of (nearly) zero-probability disastrous weather conditions in Lin (2008a, b), while in this volume, these laws are cleverly and brilliantly, as some of our readers have commented, employed to explain a good number of open problems in the studies of human organizations by providing scientifically sound theoretical explanations for some of the basic assumptions used in the studies of civilizations, business behaviors, and the mind.

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