

Oriental Way of Systems Thinking

Dong-Hwan Kim

(Chung-Ang University, Social Science College, Department of Public Administration, Korea)

Abstract

1960년대 이후 서양에서 발전된 시스템 사고는 동양 사고와는 상이한 사고 체계로 받아들여져 왔다. 피드백 시스템에 초점을 두는 시스템 사고는 오히려 전통적인 동양 사고와 유사하다는 점을 본 논문을 통하여 밝히고자 하였다. 특히 본 논문에서는 노자의 도덕경에서 자신의 행위가 자신에게로 되돌아 온다는 순환적 사고, 즉 피드백 사고를 발견할 수 있다는 점을 지적하였다. 아울러 동양의 전통적 관점이라고 할 수 있는 음양오행이론 역시 피드백 사고로 해석될 수 있다는 점을 밝히고자 하였다. 본 논문은 이러한 사상적 유사성이야말로 시스템 사고를 동양 사회에 도입할 수 있는 유연한 토대를 제공한다는 점을 지적하였다. 동양사고와 시스템 사고의 유사성이야말로 시스템 사고를 동양 사회에 적용하고 확산시키는데 있어서 지렛대의 역할을 수행할 것이다.

Keywords : systems thinking, oriental thinking, Yin & Yang, Lao Tzu, Tao
The Ching

Being developed in the western philosophies and cultures, systemsthinking and system dynamics have been regarded as a strange thinking style by oriental policy makers and business executives. Even in the monumental work of tracing intellectual roots of feedback thoughts, George Richardson (1991) failed to find out any linking pin between systems thinking and oriental thoughts. Systems thinking and system dynamics require huge changes of thinking style from researchers and policy makers. As far as thinking style is shaped by intellectual traditions and cultures, conceptual bridges between system dynamics and oriental thoughts will provide leverage points for applying systems thinking into the development of oriental society. In order to find out some intellectual roots of feedback thoughts in oriental philosophy, I investigated Tao Teh Ching, one of the most influential books in the oriental society, written by Lao Tzu 2,500 years ago. I found some evidences on the feedback thoughts and systems thinking in Tao Teh Ching. Furthermore this feedback thinking fo Tao The Ching is also reflected in the 'yin/yang five elements theory' that serves as a theoretical backbone of oriental medicine until now. Lastly a rough comparison between system dynamics and yin/yang five elements theory is made, and several leverage points for wide application of system dynamics in the oriental society is proposed.

1. System Dynamics in the Cultural Setting

Generally speaking, oriental thinking and western thinking is distinguished by their dependence on the logic and insights. They are often compared to the left brain and the right brain. The oriental thinking is regarded as consistent to the right brain thinking specializing in emotion and intuition (Ballé1994). From the perspective of oriental thinkers, the western thinking style including systems thinking and system dynamics has been regarded as too analytic to be applicable in the complex social systems.

When I developed and presented a system dynamics model for explaining the time behavior of Korean information infrastructure, my colleagues and policy makers would not take their efforts and time to understand dynamics of my model. Even simple causal loop diagram was too complicated for them to be understood. However, when explained the model in terms of oriental philosophy, they began to understand the essential dynamics of the model. Figure 1 shows two versions of presentation forms for introducing dynamic mechanism for the growth of telecommunication network (Kim & Juhn 1996).

As the number of subscribers in the on-line service grows, the value of the on-line service is increased by the effect of network externality. Most of the services in the info-telecommunications industry exhibit network externality. As the number of fax users increases, the value of fax machines to the consumers increases. For system dynamists, network externality can be interpreted as a single positive feedback loop of figure 1. However, as the number of subscribers grows, crowding effect in the network diminishes its performance and decreases its value for consumers. The crowding effect in the network can be represented as a single negative feedback loop of figure 1.

Yin/Yang diagram in figure 1 may look too simple to convey any dynamic mechanisms. However, Yin/Yang diagram has profound meanings to the oriental peoples for more than two thousand years. Particularly Yin/Yang diagram appears on the national flag of South Korea. With these cultural traditions, anyone in the Korean society can grasp the meaning of Yin/Yang diagram of figure 1. They could get deep insights on the interactions of network externality and crowding effect. Furthermore they could understand the limits to growth phenomena surrounding the evolution of networks.

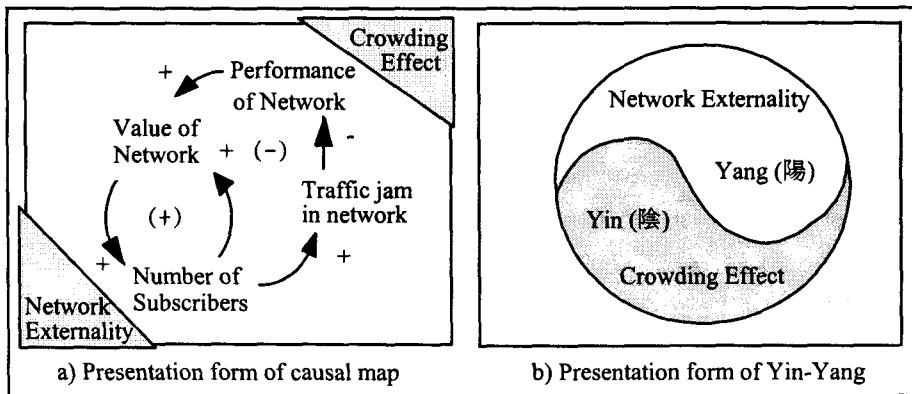


Figure 1. Two versions of presentation forms

From this experience, I realized that cultural elements must be incorporated into the presentation form of system dynamics models. However in order to integrate traditional culture and systems thinking, one must identify common grounds between them. If oriental culture and way of thinking are basically different from the systems thinking, one cannot present systems thinking in terms of oriental way of thinking. In this paper, cultural and

epistemological linking pins between system dynamics and oriental thoughts, particularly in Lao Tzu will be presented.

2. Systems thinking in the thought of Lao Tzu

Even in the monumental work of tracing intellectual roots of feedback thoughts, George Richardson failed to find out any linking pin between systems thinking and oriental thoughts. He points out as follows.

"Somewhat surprisingly then, we must conclude that early feedback control devices are essentially western inventions. Similar developments apparently do not occur in the Orient until after the rise of feedback devices in Europe. Certainly, the difficulty of finding evidence of such devices guarantees that if any did exist they had no effect on the views of twentieth-century social scientists." (1991, p.22)

He is correct, I believe, in arguing that feedback control devices had little effect on the views of oriental social science. But this fact does not guarantee that there was no feedback thinking in the oriental philosophy and social science. While social science follows after the development of physical science in the western society, philosophy and social science in the oriental society goes far beyond the world of physical knowledge. It is not surprising that oriental thinkers developed feedback thinking and applied it to the governance without making any feedback control devices.

About 2,500 years ago, Lao Tzu wrote a "Tao Teh Ching" (道德經, translated as Great Book of Tao and Virtue). His thinking was succeeded by Chuang Tzu and developed into Taoism, which has been one of the most influential thought in China, Korea, and Japan until these days. In his introduction to the translation of Chuang Tzu, Lin Yutang correctly points that "Taoism is not a school of thought in Chinese society, it is a deep and fundamental trait of Chinese thinking, and of the Chinese attitude toward life and toward society." In these countries, Taoism and I-Ching have been developed into "Yin/Yang five elements theory" that serves as a theoretical backbone of oriental medicine until now.

Feedback Thinking in Lao Tzu

The essential thought of Lao Tzu appears in the 40th chapter of Tao Teh Ching as follows:

"The movement of the Tao consists in Returning,
 The use of the Tao consists in softness.
 All things under heaven are born of the corporeal:
 The corporeal is born of the Incorporeal.
 反者, 道之動.
 弱者, 道之用.
 天下萬物生於有, 有生於無." (Tao Teh Ching, 40)

"Returning" in the first sentence means not only the process of going back to the original state, but also continuous process of feedbacks between original state and current state as clearly stated in the second sentence. The original state means chaos and emptiness at the initial time of universe. While "movement" in the first sentence describes the basic nature of Tao, the "born" in the second sentence focuses on the causal relationships of all things. This shows the feedback structure of Tao between incorporeal and corporeal. The feedback thought in Lao Tzu becomes clear when he says about the cyclic nature of Tao as displayed in figure 2.

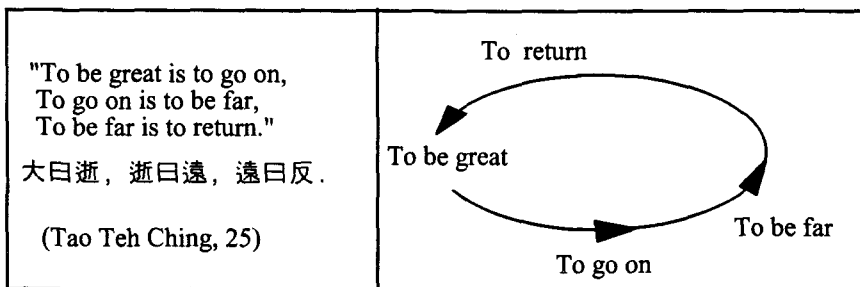


Figure 2. Feedback Thoughts in Lao Tzu

Only with the feedback thoughts, one can understand lots of contradictory and paradoxical insights of Tao Teh Ching. Tao Teh Ching begins by saying "Tao acceptable as Tao is not the Eternal Tao (道可道非常道)," which is the most famous but incomprehensible phrase. One should not regard the former as false and the latter as true. Tao acceptable as Tao (corporeal Tao) is interrelated with the Eternal Tao (incorporeal Tao). I believe that mysteries of

this phrase come from the feedback structure of Tao displayed in figure 2.

Dynamic and Endogenous Thinking in Lao Tzu

From the inception of system dynamics, the relationship between feedback structure and dynamic behavior of systems has been the epistemological premises of system dynamicists. Feedback structures produce dynamic behavior. If there is feedback thinking in Lao Tzu, it is natural to anticipate dynamic thinking to follow. In Chuang Tzu that fully developed the Taoist thesis of Lao Tzu, one can find dynamic thinking and its relations to the feedback thinking.

"The succession of growth and decay, of increase and diminution, goes in a cycle, each end becoming a new beginning. In this sense only may we discuss the ways of truth and the principles of the universe. The life of things passes by like a rushing, galloping horse, changing at every turn, at every hour. What should one do, or what should one not do? Let the (cycle of) changes go on by themselves!" (Chuang Tzu, Autumn Floods)

In the above paragraph of Chuang Tzu, one can find two occurrence of "cycle". While "cycle" in the first line means the dynamic fluctuation of system state, the second use of "cycle" in the last line means the feedback structure.

Carefully read the second and third line. The second sentence explains why we should focus on the feedback structure rather than dynamic behavior. In order to understand the dynamic system behavior, one should investigate not the truth itself but "the ways of truth" and not the universe itself but "the principles of the universe". Last sentence argues that the ways of truth and the principles of the universe is the "cycle of changes that go on by themselves". Note that this phrase contains three elements of systems thinking; feedback thinking, dynamic thinking, and closed-loop thinking with endogenous viewpoint (Richmond & Peterson 1994).

In the thoughts of Lao Tzu, all systems are self-contained and move by themselves. Any external interruption into the natural system, even if it is ethical and benevolent, will destroy the system. Lao Tzu continuously argues against *ado*(爲) and suggests *non-ado*(無爲) as an ultimate principle of governance. In this sense, some scholars regard Lao Tzu as the first anarchist in the history. However, one must remember that the essential points, Lao Tzu

emphasized, are the endogenously self-organizing natures of all systems. He admitted the necessity of governors. He urged governors to use the ways of truth and not to control by external force.

Policy Levers in Lao Tzu

How to use the ways of truth? How to avoid the temptation of external control? If there were no answers to these questions, the thoughts of Lao Tzu would not be so influential. His answers to these questions are comprised of metaphors and analogies. However, his metaphors are easy to understand. Just as system dynamicists use a water tank to explain system dynamics, he use the metaphors of waters as follows.

"Nothing in the world is softer and weaker than water;
 But, for attacking the hard and strong, there is nothing like it!
 For nothing can take its place.
 That the weak overcomes the strong, and the soft overcomes the hard,
 This is something known by all, but practised by none.
 Therefore, the Sage says:
 To receive the dirt of a country is to be the lord of its soil-shrines.
 To bear the calamities of a country is to be the prince of the world.
 Indeed, Truth sounds like its opposite!
 天下莫柔弱於水, 而攻堅剛者莫之能勝, 以其無以易之.
 弱之勝強, 柔之勝剛.
 天下莫不知, 莫能行.
 是以聖人云,
 受國之垢, 是謂社稷主,
 受國之不祥, 是謂天下主
 正言若反." (Tao Teh Ching, 78)

The policy lever for Lao Tzu is water, which flows everywhere. Water represents flexibility, small thing, weak point, humbleness, and even foolishness. Its opposite includes a hard policy, rigidity, direct interruption, control by punishment, focusing on the strong point, and clever use of opportunity. He believes in the excellence of the soft over the hard. The hard is hard

to use and brings lots of side effects. However the soft is easy to use and engulf the hard silently.

Note that the last sentence says the counterintuitive nature of truth. Forrester points out that social system is so counterintuitive that lots of reasonable policies will turn out to be disastrous. The policy lever of the soft is also counterintuitive in that it is commonly believed to be ineffective. Only a few policy makers take the soft measures to attack the hard problem. Hard problem is believed to call for hard solutions. Confronting with the big trouble we are used to referring to big measures.

However, this counterintuitive truth of the soft is hard to learn. One cannot grasp the water by his hands. The soft policy lever is not to be learned. One must learn to unlearn his learning (Tao Teh Ching, 64). Recently, lots of system dynamicists are trying to develop the method for learning systems thinking. If we adopt lessons of Lao Tzu, it will be better to develop a method for unlearning non-systems thinking and the hard strategy.

This policy lever of the soft has been widely and deeply adopted by Chinese, Korean, and Japanese strategy-makers. Sun Tzu, one of the most famous strategist for war and battle, adopted the soft strategy of Lao Tzu. Sun Tzu made many bridges between the soft strategy and the concrete skills necessary for organizing the army and winning the war as follows.

"Getting people to fight by letting the force of momentum work is like rolling logs and rocks.

Logs and rocks are still when in a secure place, but roll on an incline;
they remain stationary if square, they roll if round.

Therefore, when people are skillfully led into battle, the momentum is like that of round rocks rolling down a high mountain - this is force." (The Art of War, Force)

Sun Tzu explains the soft policy lever as round rocks rolling down a high mountain, and succinctly points out that the soft policy lever is nothing but to use the momentum and create huge force. The metaphor of round rocks rolling down on an incline reminds us Peter Senge's snowball rolling down a mountain (Senge 1990). Until nowadays his book, The Art of War, has been chosen as the most valuable book for the business executives, politicians and army generals.

3. General Thinking of "Yin/Yang Five Elements Theory"

Even though the thought of Lao Tzu and Chuang Tzu demonstrates basic properties of systems thinking, their phrase were so metaphoric and abstracted that their way of thinking could not be permeated into the broader range of people with little knowledge. It is only after the development of Yin/Yang five elements theory that their thinking gets wide popularity. Yin/Yang five elements theory was developed by close interactions between the thoughts of Lao Tzu and Chuang Tzu and the thoughts of I-Ching (Book of Change), the oldest book of Taoism. Chuang Tzu clearly connected the feedback thoughts of Lao Tzu to the Yin/Yang concepts of I-Ching as follows.

"Of old, when Yao governed the empire, he made the people live happily; consequently the people struggled to be happy and became restless. When Chieh governed the empire he made the people live miserably; consequently the people regarded life as a burden and were discontented. Restlessness and discontent are subversive of virtue; and without virtue there has never been such a thing as stability.

When man rejoices greatly, he gravitates toward yang (the positive pole). When he is in great anger, he gravitates towards yin (the negative pole). If the equilibrium of positive and negative is disturbed, the four seasons are upset, and the balance of heat and cold is destroyed, man himself suffers physically thereby."(Chuang Tzu, On Tolerance)

We can find the meaning of Yin and Yang in Compton's Encyclopedia as follows. "Yin and yang mean literally the 'dark side' and the 'sunny side' of a hill. In Chinese and much other Far Eastern thought, Yang and Yin represent the opposites of which the world is composed: light and dark, male and female, heaven and Earth, birth and death."Complementary and contrasting combinations of Yin and Yang are believed to generate five basic elements (五行) of the universe.

Five basic elements are represented by tree(木), fire(火), earth(土), gold(金), water(水). These five elements are interrelated by causal relationships. There are two kinds of causal

relationships: promoting and counteracting. The promoting relations can be regarded as the positive influence in system dynamics, and the counteracting relations as the negative influence. Figure 3 shows the famous map of promoting/counteracting relationships among five elements. It has served as a basic analytical framework in medicines, philosophies, and governments for two thousand years (Kwon 1996, Seo 1995).

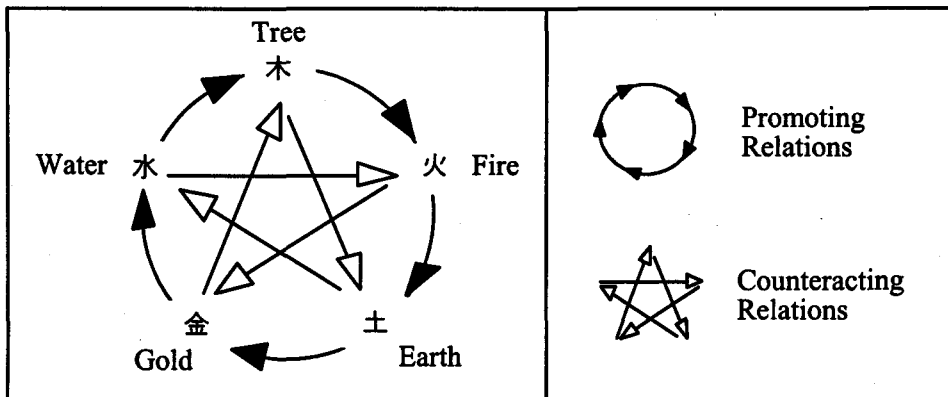


Figure 3. Feedback Structure of Promoting/Counteracting among Five Elements (五行)

These relationships can be understood with the everyday life examples. For example, you can make a fire with tree, the fire converts various kinds of materials into trash and earth, the earth produces gold and ores, gold and ores transforms moisture into water, and water fosters the tree. On the contrary, the water extinguishes the fire, the tree destroys the earth with its roots, the fire melts the gold, the earth oppress the flow of water, and the ax made of gold cuts down the tree.

Although we can find some evidences of operational thinking with stock and flow in Lao Tzu and Chuang Tzu, it is hard to say that oriental way of thinking has developed operational thinking with the concept of stock and flow. Five elements are basic building blocks of oriental dynamic thoughts, just as the stock and flow are those of system dynamics. Note that the basic building block of oriental dynamic thinking is not a variable but a feedback loop!

Each five elements are conceptual variables, with which one can analyze any systems. However, the fundamental properties of five elements are much more complex than those of stock and flow. If you want to apply the five elements theory to a particular system, you

must find out all five elements in the system. Furthermore, the five elements theory presumes that a system can be represented by one set of five elements composing of single positive feedback loop of promoting relationships and single negative feedback loop of counteracting relationships. In this sense, five elements theory has general properties rather than operational properties. With the operational properties of stock and flow, system dynamicists construct their own model with lots of feedback loops interconnected. With the general properties of five elements theory, the number of variables and feedback structures of the model are fixed. Modeling with five elements theory means one-to-one matching processes from the real system to the basic five elements. Table 1 shows the representative applications for various systems (Kwon 1996).

Elements System	Tree	Fire	Earth	Gold	Water
Five Senses	Eyes	Tongue	Lips	Nose	Ears
Body	Liver	Heart	Stomach	Lung	Kidney
Feeling	Angry	Pleasure	Apprehension	Sorrow	Fear
Season	Spring	Summer	End of each season	Autumn	Winter
Direction	East	South	Center	West	North

Table 1. Representative applications of five elements perspective to various system

One can find the similarity between the five elements theory and the living system theory of James Miller (1978). He developed the concept of general system theory into 19 functions (recently extended as 20 functions) that is necessary and sufficient for all kinds of living system. With the framework of his living system theory, researchers have no flexibility on the structure of their own model. As the case of living system theory, five elements theory provides an easy-to-apply framework for various kinds of system but oppresses the idiosyncrasy of particular systems. Without representing the idiosyncratic structures of particular systems, it is difficult to operationalize the model. That is why the Yin/Yang five elements theory has served mainly as a general thinking framework rather than as an operational tool.

4. Linking Pin between System Dynamics and Oriental Way of Thinking

Because of the gap between the general thinking property of Yin/Yang five elements theory and the operational thinking property of system dynamics, it seems almost impossible to integrate them harmoniously. However, we think that they can benefit each other at least in the stage of identifying important variables and in the stage of presenting the insights of system dynamics to the oriental policy makers. Table 2 shows some conceptual linking pins between oriental thinking and systems thinking.

Oriental Thinking		
yinSystems thinking		
yang sink		
Promoting Relations (相生)source		
Counteracting Relations (相克)positive causality (+ sign in causal map)		
negative causality (- sign in causal map)	Tree (木)	planning (goal setting)
Five	Fire (火) (strong yang)	organizing (budget/personnel)
Ele-	Earth (土)	motivating (activating)
ment	Gold (金)	controlling (correcting)
	Water (水) (strong yin)	reforming (terminating)

Table 2. Yin/Yang five elements vs. system dynamics

In tables 2, five basic elements are compared to the five functions necessary for system development, growth and decay (Seo 1995). With linking pins in table 2, one can make the feedback structure among five elements more friendly to system dynamicists as in figure 4. Figure 4 shows the feedback structure of five elements in system development and its application to the question of why the crowding effect of networks occurs. In the right diagram of figure 4, a shaded variable and a dotted arrow means the dominant relationships. As the number of subscribers of networks grows, the voice of a marketing section grows, and the voice of evaluation section diminishes. This keeps the planning section from making a plan for expanding its networks and results in the network jam by crowding effects.

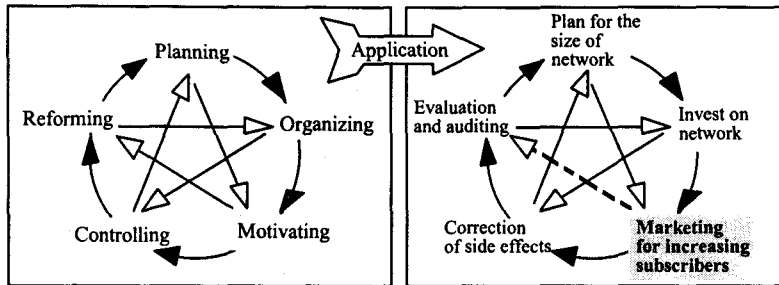


Figure 4. Feedback Structure of System Development from Five Elements Perspective

5. Conclusion and Future Research

In this paper, feedback thoughts in Lao Tzu and in Yin/Yang five elements theory are introduced, and I proposed a tentative general framework by which system dynamicists can communicate with the oriental thoughts and with the oriental policy makers more friendly and conveniently. However, I do not think nor insist that the oriental thinking is confined to that of Lao Tzu, Chuang Tzu, and five elements theory. Admitting the fact that there have been vast array of thinkers in oriental society, I hope that there will appear more and more study on linking them to systems thinking and system dynamics. As long as system dynamics requires continuous and dynamic changes of our thinking style, we should identify the roots of our thoughts and build our cultural interfaces between traditional thoughts and systems thinking.

[References]

- Ballé Michael. (1994). *Managing With Systems Thinking*, McGraw-Hill, London.
- Chuang Tzu, B.C. 3, *Chuang Tzu*, translated by Lin Yutang, <http://www.monash.edu.au/cc/staff/sas/sab/WWW/zhuangzi.txt>.
- Kim D.H. and J.H. Juhn, "Dynamics of Networks: System Dynamics Model for Network Externality and Critical Mass," *Proceedings of the 1996 International System Dynamics Conference*, Cambridge, Massachusetts.
- Kwon Il-Chan. (1996). "A Model of Human Being in Oriental Medicine," (in Korean language), *Proceedings of Summer Conference of Korean Association of Public Administration*, Seoul.
- Lao Tzu, B.C. 5, *Tao Teh Ching*, translated by John C.H. Wu. (1989). Shambhala Publication Inc., Boston.
- Miller James G. (1978). *Living Systems*, McGraw-Hill, New York.
- Richardson G. (1991). *Feedback Thought in Social Science and Systems Theory*, University of Pennsylvania Press, Philadelphia.
- Richmond B. and S. Peterson. (1994). *An Introduction to System Thinking*, High Performance Systems Inc.
- Senge P.M. (1990). *The Fifth Discipline: The Art and Practice of the Learning Organization*, Doubleday, New York.
- Seo U-Seon. (1995). *I-Ching: Wisdom of Utilizing Change*, (in Korean language), Munhac Academy Press, Seoul.
- Sun Tzu, B.C. 1, *The Art of War*, translated by Thomas Cleary. (1988). Shambhala Publication Inc.. Boston.