Four Practical, Computer-Based Tools for Using General Systems Processes as Guidelines for Korean Reunification

Len Troncale
Chairman, Dept. of Biological Sciences
Director, Institute for Advanced Systems Studies
California State Polytechnic University
3801 W. Temple Ave., Pomona, Calif. 91768
(909) 869-4038: lrtorncale@csupomona. edu

Abstract

This paper describes four new computerized "tools" that simplify the use of sophisticated systems knowledge for the design of complex social systems. It argues for conscious and deliberate social system experimentation and evolution using general systems isomorphies as guidelines. It focuses on two long neglected systems processes, integration and fragmentation, for their potentially key role in Korean reunification. It presents four computerized tools to fill the need created by the surprising lack of practical integration tools in our modern world. The paper clusters thirty insights into reunification into two different taxonomies to ease the complexity of their use. It describes a computerized data base "thinking tool" that would organize information on dozens of systems processes and the linkage propositions between them. It describes the many parallels between medical pathology and systems pathology and potential computerized use of this concept as

a "thinking tool" to guide social systems improvements. It describes how the neglected techniques of General Morphology could be used to discover significant new pathways to integration especially if those techniques are computerized in a third "thinking tool". It also describes how modern "thinking tools" for computer software development could be modified from their current use for information systems evolution to a new use for social systems development. Overall, the paper devises alternative strategies and "thinking tools" to help humans discover potentially powerful synergies and integration's that would improve social systems design and illustrates this with example applications to Korean reunification.

Keywords: General Systems Processes, Isomorphies, MultiDimensional Matrix Builder^{TM}, Software Development Tools, Systems Integration Tools, Integration Processes, Fragmentation Processes, Cycles of Integration & Fragmentation, Systems Pathology, Causes of Human Systems Malfunction, Systems Emergence, Limits on Human Systems Engineering, Troncale's Oath

1. Generic Need for a New Mindset: Practical Tools to Help in Large-Scale SocioEconomic & Political Evolution by Integration

What could be more vital to the health and welfare of a society than the design and testing of the processes by which it works? Yet if we examine the entire history of mankind up to and including our present technological age, it is amazing to note that the key mechanisms by which we design our social systems have not changed significantly in 10000 years. Our history is characterized by a lack of clear insight into the key mechanisms driving our socio-economic and political structures. The last 50 years have resulted in a great increase in our knowledge of systems theory and systems dynamics. Yet we have not made use of these discoveries of the 20th Century to help us improve our social systems. Despite the widespread influence of political decision making and legislation, they appear to be frozen by the constraints of hidden assumptions built into our religions, our ethical

systems, and our habits of institutional behavior. We are massive, multiunit systems without an effective social evolutionary component.

This paradox is even more perplexing given the many sites around the world today that are engaged in national and international realignments. Each of these cases of possible integration(Korea, NATO, European Common Market, Germany, Africa) or fragmentation(Soviet Union, Yugoslavia, the Balkans, China, Africa) involve millions of people and billions of dollars of economic system. These social experiments occur with very little cumulative wisdom and practical learning achieved from case to case, generation to generation, age to age. The most vast social experiment of the 20th Century, the decades of revolution and upheaval under Mao in China, were guided by the bias of one man, not by any increased understanding of how social systems work. In fact, severe social taboos inhibit even our discussion of the possibility of social "engineering". In the West anyone even using the term is attacked viciously as it implies violation of free will and independence. Western religious taboos disallow our inquiry into how natural systems emerge, much less inquiry into social systems origins. How can we free ourselves from the tyranny of such intellectual taboos?

We need to find "tools" to help us evolve more sensible social systems that steadily improve with each iteration and trial. These tools would be our prosthesis to make up for our apparently limited abilities in human planning. Or if you prefer, they would be an extension of our "species" brain acting as a new neural system to bring together what is as yet hopelessly separate and give our young and still emerging societal levels of organization a much needed "learning" or "evolving" component.

This paper will try to envision four possible such tools built upon the insights provided by a half century of work in systems sciences and critique each in the context of the Korean unification problem.

1.1. Influence of Expert Advisors on Political Decision-Making

A prolific number of studies conducted by the International Institute for

Applied Systems Analysis(IIASA) in Laxenburg, Austria has demonstrated that systems experts(who study the systems by which and about which decisions are made) are not tightly coupled to(are not listened to) by sociopolitical decision-makers. IIASA workers have detected a number of reasons for the gap between decision making and the information needed to make good decisions. These include: (i) the studies of systems experts are too technical; (ii) they speak a different language (the technospeak of their many specialties); (iii) their objectives are often different, if not conflicting with decision makers; (iv) they are optimizing different variables; (v) the experts have no practical, inherent political, social, or economic power; (vi) the experts cannot predict outcomes with certainty; and finally and most influential, (vii) our ethical systems do not permit "experiments" on social systems. We conclude from these observations that the concept of designing societies with conscious forethought is a forbidden concept. It is true that we constantly design social systems by default through our legislation and our politics. But ironically, this type of design is acceptable only if it is done subconsciously. The net result of this gap between those who know, and those who design and decide, are social systems that do not learn from their past mistakes. They do not evolve. We come here to the same conclusion as the last section. Tools are needed to enhance communication across this gap and to enable true social evolution.

1.2. The Promise of Improved Mechanisms for Social Progress

While we have failed to achieve efficient social evolution, we have been successful at discovering and utilizing the process of evolution in natural systems. The last decades of the 20th Century have produced dramatic progress in putting evolution to work for humans, in chemical evolution, in artificial life research, and in learning theory. We construct artificial environments in the test tube or on the computer that result in startling chemical and informational evolution in relatively short period of time and for startlingly low costs. From the early work in biochemistry by Spiegelmann that demonstrated the evolution of new characteristics in replicating RNA when threatened by RNase attacks in a test tube,

to the new uses of combinatoriall chemistry to speed the design of new drugs, to use of genetically designed mutated organisms to study disease, ample evidence has accumulated that chemical as well as life systems respond to the process of evolution by selecting useful variants. Brain research and neural net theory has shown how the "learning" function of higher living systems is a natural progression from the "evolving" function. They have instructive similarities. Yet none of this knowledge of how to use evolutionary processes has been applied to social systems evolution. If we could benignlly apply the lessons learned in natural systems to social systems we might begin a whole new era of human progress. This paper suggests that there are tools which will help apply these lessons.

1.3. Lack of Training in and Tools for Social Systems Integration

One of the hallmarks of this chemical and life systems evolution is the integration of formerly separate and competing entities into cooperating networks, and finally into new units, or new levels of organization. In fact, many of humankind's most important achievements have resulted from integration. New and very powerful theories such as electromagnetism, relativity, and genetics have resulted from integration. Great civilizations have resulted from integrations. Major social movements have resulted from integrations. My last paper in this series presented many examples of social systems integration and analyzed(distilled out) the specific mechanisms by which they occurred. Yet where in our colleges and universities do we directly teach the skill of integration? What tools can you point to whose sole or main purpose is integration? How can it be that integration and synthesis is so important to humankind and yet so neglected by humankind? Our lack of success in social systems evolution might be the result of this dearth of practical knowledge of and tools for integration.

1.4. Four New Tools for Applied Social Evolution

This paper outlines four possible tools for integration. It summarizes the very detailed description of successful, evolving systems made possible by systems science, and then uses the summary to generate prescriptions for social systems. It describes two computer-based tools that expand human perception and tracking to enable application of those detailed prescriptions. It analyzes "integration" itself as a key process for successful evolution of a system. Finally, and perhaps most importantly, it suggests a shift in mentality and values that would perceive social engineering as similar to the interventions and healing typical of medical engineering.

1.5. Relevance of Integration Tools to the Korean Unification Problem

The literature on the possible reunification of South and North Korea is filled with detail and represents an immense scholarly effort[1-35]. But it is difficult to keep so many facts and trends, causes and effects, constraints and potentials, needs and responsibilities in mind at one time. How similar and how different are the cases of European union, German reunification, and international corporate networking? What lessons can be learned from them for Korean reunification? Without an overall and orderly scheme of comparison, Korean workers are faced with the same lack of cumulative wisdom that faced past generations. Perhaps these tools dedicated to systems overview and integration insights would be useful to this and other cases of emergence of a new social organization. Please accept my apologies for even attempting to apply these very general systems tools to the specific case of Korean reunification since my knowledge is so very limited compared to that of my audience. I am very impressed with the diversity of the reunification literature[1-37], [45-48], and its presence even on the international world wide web[23], and the many organization dedicated to its advancement(e.g. the Research Institute for National Unification, and the Korean Association for International Studies). Please accept my humble attempt to add additional tools to this important effort.

2. Clustering of General Systems Guidelines for Korean Unification: Criteria for a Working Taxonomy

In the last paper of this series, I presented 30 "rules" or "insights" derived from systems science that might be relevant to the systems problem of Korean Reunification. These were only a sample and are included here as Table Four. The systems technique presented in that paper could result in many more insights. One problem with this approach is the sheer number of "suggestions" offered. Even the sample included too many insights for comfortable application. This paper addresses that problem by providing a clustering or taxonomy of those "rules" and then offering four alternative tools for helping Korean practitioners generate more. In addition, these tools would help them manage and make the most of the resulting large number of insights. All four are "thinking" tools, "discovery" tools, and "application" tools simultaneously.

One possible taxonomy for the 30 rules described in[45] would result from clustering the precepts by the systems isomorphy that led to the insight. For example, #'s 1, 2, 3, 4, 8, and 28 involve hierarchical form and function, while #'s 5, 6, and 10 involve cycles and cyclicity, and #'s 19-22 involve duality. This type of clustering of the many rules is particularly powerful when used together with the "linkage proposition systems model"(LPSM) described in the next section. When used with this tool, the rules are connected with easily accessed data and information on the various systems processes and their examples in many natural systems. However, many workers will be more familiar with the political systems that the rules apply to than the highly abstract and theoretical categories represented by isomorphies and their linkages. So the strength of this clustering is also its weakness.

Another possible taxonomy for the 30 rules described in[45] would be based on the application domain to which the rule most easily applies. While most workers would find this approach closer to their practical knowledge, it suffers from what I have called the pervasive "applications dilemma"[39 & 42]. It is easy to memorize the rules and prescriptions of texts devoted to insight, morality, and behavior(e.g. the Christian Bible, or the Tao Te Ching). But is much harder to know precisely how the rule applies to the very specific situation an individual is facing at the moment. In both the religio-philosophical and the systems situation the problem is the same. It is a problem of deabstraction. Christian rules are general; systems rules are general. The wisdom involved in both in not only the wisdom of the formulating of the rule, but the wisdom shown in its application. So this second taxonomy has its own weakness.

2.1. Korean Reunification Involves Fragmentation and Integration: We Need to Learn from Past I & F Cycles

Most of the "rules" or "precepts" described in the last paper concentrated on either the process of integration or fragmentation because the Korean problem resulted from a social systems fragmentation(the original North: South split) and any reunification would be a complex act of integration. In fact, the long history of Koryo itself is the result of a series of cyclical integrations and fragmentations(the northern & southern tribal leagues, ancient chosan, the early three kingdoms, the Silla dynasty, the later three kingdoms, the Koryo dynasty, and so on), as indeed is the history of many nations and regions. So the process for generating the "rules" and "precepts" focused primarily on either the process of "integration"(in order to learn the proven ways of accomplishing integration), or on the process of "fragmentation"(to avoid the ways things come apart), and thus also favor integration. Using the general systems hypothesis, we did not restrict ourselves, however, from studying only integration and fragmentation events in social systems. Despite their obvious surface differences, we felt there was much to learn from numerous case studies of integration and fragmentation from both the natural and social sciences occurring across a vast timespan of 13 billion years.

2.2. Integration & Fragmentation: Neglected Systems Processes

Ironically, most lists of systems mechanisms and systems studies do not even mention the processes of integration and fragmentation. So, since the ISSS Presidential Address of 1990, we have been accumulating evidence on these two fundamental processes. It is clear from this analysis that I & F are indeed systems events. Very large numbers of subsystems are involved in either event. They are clearly a feature of complex systems that exhibit elements of chaos and of emergence of new features at new scalar levels of organization or behavior. At this conference, we used dynamic graphics to show some of the most essential features of I & F in an effort to better communicate I & F features to participants.

Figure One shows three intermediate stages in the growth of a tree as a graphic metaphor of the systems process of fragmentation. Originally this was an animation showing the tree branches forming(fragmenting) progressively over time. Many case studies of fragmentation such as emergence of different languages, emergence of different cell types in embryology, emergence of different species in evolution, and many more, can be graphically summarized using this animated metaphor. As always in general systems theory, we are using only very general aspects of the analogy, not its specifics. Tree branching is well understood in terms of its particulars and those specifics are unique to that type of branching. The other examples of fragmentation from emergence of star types to the breakdown of empires share a definable set of generic similarities that are graphically captured only in the general aspects of the tree metaphor(share trunks; branches as cohorts; scale down; spatio-geometric sequestering; etc.). Most importantly, the earlier paper described a dozen mechanisms by which fragmentation occurs in most systems regardless of their particulars.

Figure Two shows three stages in the confluence of a river as a graphic metaphor of the systems process of integration. Originally this was an animation showing that very distant creeks found their way to joining into streams, and those coalesced into rivers(integration) progressively over time. Many case studies of integration such as origins of a nation, an empire, or a civilization, the original integration of the first cell, integration of matter into planetary systems or galaxies, cooling of subatomic particles into atoms, and many more, can be graphically summarized using this animated metaphor. Again, in general systems theory, we are using only very general aspects of the analogy, not its specifics. River drainage systems are well understood in terms of their particulars and those specifics are unique to that type of integration. The other examples of integration from origins a new neural net(meme) in humans to the origin of a religion share a definable set of generic similarities that are graphically captured only in the general aspects of the river metaphor(driven by underlying economies of space, time, matter, or energy; increase in size; dependence on a more vast context; result from renewable flows; etc.). Most importantly, the earlier paper described a dozen mechanisms by which integration occurs in most systems, regardless of their particulars. These mechanisms were the source of many of the "rules" that might inform Korean reunification.

Figure Three is a non-interactive snapshot of the originally interactive, multimedia graphic shown at the conference which catches 13 billion years of I & F events in a single picture. Shown are a series of 10 selected integration events and 10 selected fragmentation events arranged in an unbroken series of successive origins. Each of the spheres is actually a live "button". Invoking each button brings up a series of scenes or graphics that describes that particular real case study of an integration or fragmentation event in history. This one picture summarizes an immense amount of human knowledge, as well as time, and has several important features: (i) notice that each set of integrations or fragmentations is separated by either the above described metaphorical symbol for fragmentation(one to many branches) or the metaphorical symbol for integration(many to one); (ii) both natural systems and social systems are included in one flow across time because of their I & F generic similarities; (iii) natural systems are shown to give rise to each other and eventually to social systems with the appropriate scientific evidence for each; (iv) we selected alternating integrations and fragmentations to show how ten

I & F cycles have occurred over the 13 billion years covered; (v) the one picture includes numerous examples of I & F so that all I can be compared as well as all F; (vi) a verifiable, and real timeline can be applied to the picture; (vii) the whole sequence indicates how past fragmentations enable future integrations; (viii) the whole sequence indicates how past integrations enable future fragmentations; and (ix) the organization and presentation of the entire sequences as interactive, computer-based multimedia graphics indicates how useful this technology is as a prosthesis for the human mind to "see" what was hard to see before. This presages the utility of the other computerized tools presented in this paper.

2.3. The Four Tools Presented Here Embed I & F Cycles in a Rich Systems Context, Are Interrelated, and Each Adds A New Dimension

We will now introduce four new computerized tools for the human mind. They present new ways for the "species brain" to expand and evolve new capabilities. All are focused on the above-described need for better techniques and tools for integration and synthesis in human thinking and action. They are also all focused on full utilization of other general systems processes beyond just those of integration and fragmentation. The purpose of the first tool is to enable the human mind to understand, encompass, and use a large number of systems processes in a very detailed manner and apply them to complex problems in detailed, not abstract ways. The linkage propositions between many other systems processes and the systems processes of integration and fragmentation produces a set of statements that embeds I & F cycles firmly in a systems context. The purpose of the second tool is to apply to our first feeble attempts at conscious systems intervention, the valuable lessons learned from the long and slow evolution of medicine from its earliest to its modern practice, and to imitate its current great successes. The purpose of the third tool is to simplify and enable application of the long neglected techniques of general morphology to the discovery of new integrative solutions. This is an example of a tool that could be widely disseminated with a hopefully concomitant improvement in synthesis activity in human affairs.

2.4. The Asian Mindset May Be Pre-Adapted to Effective Use of Modern Systems Concepts and These Tools In Particular

It is always a partial error to ascribe any one way of thinking to an entire social group, especially one as large as a civilization. There is much diversity in such large groups. However, there clearly is an established literature on various "mindsets" or "weltanschauung" of populations, and there are also recognizably "dominant" ways of thinking shared among large numbers in identifiable cohorts within a social group and between social groups. Many workers have pointed out that Chinese, Korean, and Japanese civilizations have a greater respect for and use of holistic approaches than typical of Western civilization. Ancient philosophies like that of the Tao and the lineage of wisemen in the Buddhist traditions have many similarities with systems science[39], [see also the unpublished *The Tao of Systems Science: Systems Science of the Tao*]. The teachings of these movements are so pervasive and fundamental to some Eastern societies that one may be forgiven for using it to characterize the development of many individuals in those societies. Since these tools are based on systems concepts, and are also focused on holistic-based synthesis and integration, it appears that the tools might be more congruent with Eastern ways of thinking than those of the West. Furthermore, you will notice that each of the tools requires the social cooperation of very large numbers of knowledge workers for their successful implementation. Again, this favors the Asian mind. The teachings of Confucious and the ancient traditions of loyalty and respect for ancestors have led to a comparatively greater interest in cooperation in the East. While the West, especially America, emphasizes the individual and independence, the *chaebol* of Korea and the *keiretsu* of Japan exemplify the degree to which the Eastern individual is prepared to work very diligently on commonly shared goals in very large organizations. For any of the tools described here to be successful, the cooperation of very large numbers of knowledge workers is required. They must diligently learn the techniques and apply them uniformly and

in great detail over relatively long periods of time for success. This task may be more amenable to the Eastern mindset, than the West. Ironically, tools initially devised in the West might find their strongest implementation in the East.

3. "TOOL" ONE: The Computerized Linkage Proposition General Systems Model (LPSM)

One of the special contributions of our Institute for Advanced Systems Studies is the gradual evolution of a very detailed computerized data base of systems concepts that we have organized in a way that promotes understanding and application. We call this database GENSYS and its three major components are isomorphies, linkage propositions, and animated graphics. It is one of the most detailed general systems theory extant because it attempts to trace the very specific mechanisms by which most systems appear and survive. We are trying to computerize it to help in its dissemination and use for practical systems problem solving. When connected to the growing natural system literature, it becomes a vast computerized data source we call META-GENSYS that is useful for both systems design and systems education.

3.1. What Are General Systems Processes or Isomorphies

The founders of general systems theory referred to comparisons between real systems and they called the similarities they found "isomorphic". It was the discovery of these similarities that gave birth to the hope that humans could find a general theory that described all systems. But we have boldly changed the discourse from human description of comparisons, which are therefore intellectual, mental terms expressed in adjectives to adverbs of comparison that are distant from the real systems, to nouns that name parts of real systems. To us, isomorphies are very real and not just comparisons. We describe them as even preceding the origin of the systems they are found in because they are the most stable way for multitudes of things to interact, at any scale size, given the basic physics and math of our universe. This is why they are found to be similar to many different systems of different types at different scales. And that is why the should be "names" or "nouns" that describe systems; they are that crucial to systems origin and function.

After careful study of many natural systems, we focus only on internal interactions of these systems that cause them to be in the first place. To our GENSYS model, isomorphies are the very most fundamental systems processes or mechanics of being. We purposely eliminate from our working list of isomorphies many terms common to other system's investigators if the term does not name a very specific mechanism or process. Many common systems terms are used merely to classify or define or describes human methods of study of systems, or are humanocentric(anthropomorphic). None of these types of terms describes a process or mechanism inherent in the system itself, which makes the system work. We eliminate all such terms as isomorphies. This helps us see more clearly how systems work. It reduces and simplifies an already long list and focuses the worker on only those essential mechanisms responsible for systems survival. Please see[44] for a list of a dozen criteria that define our search for true isomorphies and for examples of many classes of eliminated terms.

3.2. Why Are Isomorphies Relevant to Korean Reunification?

Since isomorphies are so fundamental to systems function, they are present in virtually all "mature" systems. Natural systems, from which our Institute derives most of the information about isomorphies, have been present and stabilizing for millions to billions of years. Time has optimized their performance. So we describe them as "mature" in terms of exhibiting isomorphies. They also allow for more objective, experimental study by humans. These are the reasons why we use natural systems to detect and define isomorphies. Social systems are less "mature" than natural systems, because they are newer. They are also more artificial because human will can cause them to follow pathways that do not minimize energy, space, matter, etc. at least for a time. But our working assumption is that even social systems would work better if they did embed and evolve according to the

established mechanisms of systems isomorphies. So the long list of isomorphies becomes a very specific and powerful diagnostic tool for analyzing any current social system to see if it is working as effectively as it might. They become a prescriptive list to fix malfunctioning systems. The analogy to medicine is obvious and helpful, and is developed as tool described below. Since the problem of Korean reunification is a specific case of social system optimization or repair, the isomorphies become a "thinking and discovery" tool for examining the problem and planning change. Thus, this LPSM becomes a "tool" for discovering the obstacles to reunification, and for imagining practical ways to overcome the obstacles.

3.3. A Working List of General Systems Isomorphies

Table One is our working list of 80 systems processes to be included in GENSYS. This list has grown from the original 50 included in[44] to this longer list, and continues to grow with the two new isomorphies described in this series of papers-integration and fragmentation mechanisms. Such a long list of key mechanisms and processes, however, rapidly becomes unmanageable for the limited information capacities of humans. So we have clustered the list of isomorphies as we have preliminary systems maxims in Table Two. Recognition of some of these categories became the basis for recognizing that most systems exhibited the same general systems life cycle(Figure's Four and Five). The real value of the isomorphy list comes from the extensive literature that exists on each isomorphy and its role in the behavior of real systems. This expands the information considerably. While the expanded data is more useful, it is also more unmanageable. So we are trying to devise computerized tools that help apply the information in the LPSM. Tools three and four describe below are intended to help apply the LPSM.

3.4. What Are General Systems Linkage Propositions?

Isomorphies, or fundamental systems processes, do not exist alone and isolated from each other. The most basic insight of systems theory is that everything interacts. Isomorphies also interact. Because the isomorphies themselves are so fundamental, their interaction is also very fundamental. Because all essential systems functions derive from isomorphies, the interactions among isomorphies are also fundamental to systems function and health. We have called the basic interactions among isomorphies, "linkage propositions". We carefully limit individual SLP's(system's linkage propositions) to a particular influence of one single isomorphy on another single isomorphy to provide detailed resolution. Each SLP is expressed in a language phrase, which describes the influence and its direction. While there may be only 100 or so isomorphies, each has numerous interactions with virtually all the other isomorphies. So the set of linkage propositions is very large, perhaps 1,000's. But they are so fundamental that they are a self-organizing, self-defining set. We call them "propositions" to remind systems workers that while there is a great deal of information to support the existence of any one isomorphy, there is only limited evidence for each SLP. We remind ourselves of this limited evidence, and the need to accumulate more evidence across many real systems by calling them "propositions".

3.5. A Taxonomy of General Systems Linkage Propositions

Reference[44] shows some examples of SLP's and the main classes of SLP's discovered to date. The detail provided to study of systems in general by the numerous SLP's is much greater than that provided by other general theories of systems. This greater detail increases its utility of diagnosis, analysis, and prescription of systems malfunctions. The greater detail is reflected in the classes of SLP's recognized to date. Grouping the SLP's in clusters helps in their learning, use, and management. Please see[44] and its later derivative series of papers for a more detailed explication of the SLP's and their alternative taxonomies.

3.6. A Graphics-Based, Computerized LPSM Helps Application of Systems Insights

The thousands of SLP's demand a computerized tool to help in their use. We are working on computerized graphics that are tied to the English language (or potentially any language) versions of the SLP's. We are also exploring the use of language-based interpretative threaded computer languages(e.g. PROLOGUE) that would turn the SLP's into a true expert system knowledge base. Some of the current graphics versions use the clustering of SLP's by the isomorphies that they connect. Figure Four shows this computerized graphic interpretation rendered in a form that not only delivers the LPSM, but also organized it in a general systems life cycle. Putatively, each major bubble is a "life cycle stage" common to any system's origin, development, evolution, and decline. The smaller bubbles are the isomorphies that act as the mechanisms that give rise to that stable stage. Clicking on any of these graphic bubbles would access the LPSM database of information for that item. Each of the lines shown in Figure Five is a SLP. Clicking on any line then would bring up that linkage proposition statement and a double click would lead to its information from the LPSM database. This graphic then becomes a tool to use in exploring the incredible detail behind the LPSM.

3.7. Applications of the Graphics-Based, Computerized LPSM to Korean Unification

One of the problems with Korean reunification is the imagineering of new and creative ways around the obstacles that inhibit the anticipated socio-economic and political integration. This series of papers describes how systems have historically accomplished integration and suffered its opposite, fragmentation. They provide many models and experiments on how integration can be accomplished and how further fragmentation avoided. The LPSM and its graphic tool would enable a much more detailed exploration of these two isomorphies and their many linkage propositions. The detail in the model could provide many alternative suggestions when the generals of the model are matched with the specifics of the Korean situation. The already existing network of scholars and workers in Korea dedicated to solving this problem is very large, and such a large group of cooperating workers would be necessary to capitalize on the potential of this tool.

4. "TOOL" TWO: Using "Systems Pathology" as a Tool

The systems literature has few, if any examples of systems malfunctions consciously described as "systems pathologies". It appears that practitioners prefer to speculate endlessly on systems optimization rather than focus on the more limited and humble question of how systems are not working in specific instances, and how specifically they can be "cured".

4.1. Utility of A Medical Analogy for Improving Human Systems Engineering

The human brain is adept at using metaphors and analogies. They help us understand disparate things. They help us understand new things in terms of known things. One of the greatest success stories of modern man is the steady progress in medical cures for threatening diseases. Could we learn how to better approach social systems "diseases", or political systems "diseases" by approaching them as medicine approached organic disease? Could we develop a more productive way of improving social engineering by emulating the way biological research improves medical practice?

There are many similarities between problems in social systems design, such as the Korean reunification problem, and the practice of medicine. First, both should focus on when things don't work rather than trying to understand how things work. Disease is a powerful tool for concentrating effort and restricting it to attainable goals. Second, both involve very complex systems and social systems are not more complex than biomedical systems. Often people misunderstand the complexity of a system due to its composition. Social systems are made up of humans and humans of cells. So it is easy to think that social systems must be more complex than humans and humans more complex than cells because each successive entity is at a higher level of aggregation. But complexity is more a function of the number of different interacting entities per UNIT than interacting entities IN TOTO. A human may seem more complex because it is made up of cells, but the cell is actually more complex given its tiny size. There are perhaps 200 cell types interacting to make up a human according to the latest studies, but a human cell has over 100,000 interacting molecular species according to the latest studies. Modern medicine is essentially an application of cell pathology, so modern medicine studies a very complex system. Third, modern medicine investigates only those interactions that lead to a particular dysfunction to understand its causes. It does not try to understand all interactions, which it still cannot after 2000 years of study. Social systems design should similarly focus on particular dysfunctions rather than trying to understand the whole system. This is quite a departure from current practice. Fourth, experimenting on humans is disallowed in medicine, just as experimentation on social systems is disallowed. So medicine had to discover reliable ways to investigate diseases without direct experimentation. Medicine accumulates many observations on the course of a particular disease without intervention. It develops simpler models of the disease in simpler systems. So must social systems engineering.

4.2. Medical Techniques to Emulate in Social Systems Prescriptions

The practice of medicine is so rich that it provides a long list of historical breakthroughs that social systems design should repeat in its domain and a long list of terms we should borrow directly. The length of this paper allows mention of only a few examples. First, we need to classify social systems problems in the detail that medicine has classified its diseases. It did this first. Often these classifications revealed important causes of different types of diseases. Do you know of a comprehensive classification of social systems design problems? Have the many so-called systems designers reached a consensus on this list? Second, we need to identify diseases more quickly as they develop. Many medical syndromes are named after the investigators who were the first to piece together what originally appeared to be disparate cases to see the underlying similarities that were consistent with one disease. Third, the concepts behind the term's symptoms, diagnosis, prognosis, and prescription could be used directly in social system medicine. A particular disease, once recognized, would have a listing of effects that follow from the disease. Over years of investigation, these effects are all clues that lead back eventually to the causes of the disease. Fourth, important breakthroughs in modern medicine have to be repeated in social systems design. For example, much of modern medicine derives from the first recognition of the causal relationship between inborn errors of metabolism(diseases) and dysfunctional enzymes(a particular cause). This discovery, made by Garrod, paved the way for later understanding of gene mutation as the cause of many human diseases. There are many more "transfers" of technique and insight possible between medicine and human systems design.

4.3. Fundamental Human Causes for Human Systems Malfunctions

In a past paper, I tried to list some of the most important systems causes of social system malfunction[42]. I focused on habits of human thinking and limits on human perception that were the primary causes of their poor design of social systems. I mention only a few here because they are compared to social systems design what genetic mutations are to human disease. Because of this, they are a very fertile area to which we can apply the thinking tool of a medical analogy emphasizing social systems design. One of the fundamental human causes is our very poorly developed sense of time and memory of time. Feedback loops are very important in natural systems to keep them within limits of the environmental parameters upon which they depend. Each feedback loop has been selected for by long-term evolution to be appropriate for the interactions it regulates. However, in human systems, we design the feedback loops. Very often our feedback loops are

either only weakly coupled to the interactions they are supposed to control or our poor sense of time results in their being too slow or too fast to be effective-often with disastrous results. Another consequence of our poor sense of time is we emphasize systems structure and see it first, and only very much later recognize the equally important aspect of systems dynamics. The static structure, when considered in isolation, leads to mistaken understanding and poor interventions. Also humans are very limited in the number of variables that they can keep in their mind at one time. Psychologists have proven that this might be less than seven variables we can be conscious of at any one time. This limit leads to an inability for use even to perceive, much less act on the many variables impacting most systems problems. Each recognition of a fundamental human cause of system malfunction can be matched with a prescription to avoid its consequences. For example, the computerized comparison cube described in the next tool would help extend human perception and manipulation of multiple variable interactions. Or as another example, conscious skill at representing variables in clustered hierarchies or networks would help overcome our limits in perception.

4.4. Applications of Systems Pathology to Korean Unification

Foreigners should be timid at suggesting external solutions to the internal social problems of another country. However, that is exactly what is currently happening in Korea. The International Monetary Fund is imposing new rules of operation on Korea to alter past practices in its economy and industry. These changes are supposedly aimed at correcting a past pathology, namely the lack of competition and market selection operating due to government intervention and the *chaebol* system. It may well be that the so-called past pathology was absolutely necessary for a rapid initiation of capital, but that its time has past and now what was good at one time is a pathology for the present. It is interesting that this same case study is also an example of a pathology of feedback loops as mentioned in the last subsection. The Western nations are dominated by specialists that insist that the feedback loops of the open market, usually characterized as unforgiving and based upon fundamental economic indicators, are the best regulators of the economy. Indeed, it is true that if the market is truly open, then the influences on it are multitude and cannot be easily anticipated by human planning. Thus, they say the health of open markets over planned economies. The limited open market of Korea, influenced by networks of human association, were more susceptible to human error or human systems pathology because of the natural limitations of the human intellect and the special interests of subgroups of partners. There are even easier examples of systems pathology evident in examination of the policies and practices in the North Korean economy. This is a totally planned economy where virtually everything influenced is artificial and not attached to fundamentals. The absence of selection, however, is a pathology common to both, but to grossly different extents and for different causes. Ironically, the advice of the West in this regard may ultimately prove useful and successful, but not because of better human planning in the West. It is because of exactly the opposite. Westerners do not intervene much at all in the economy, and that is the strategy that is most successful.

4.5. Social Systems Intervention Needs an Oath Analogous to the Hippocratic Oath

One final similarity between medicine and systems design intervention is humbling, but essential to adopt. Like systems design practiced in the present day, ancient medicine attempted to intervene in complex life processes to improve them. However, early practices such as applying leeches to remove "bad blood" were very often more harmful than attempting no intervention at all. So very early in the history of medicine, ca. 400 B.C., one of its most insightful practitioners issued an oath which doctors even today adopt at the onset of their careers. He removed the practice of medicine from the domain of superstition and religion, just as today we must remove systems design from the tyranny of taboos and uninformed interventions. The Hippocratic Oath is very simple. Much of it can be expressed in one powerful phrase: DO NO HARM. In spite of the insights of

Hippocrates, medicine often continued poor practices until the 1800's. The extensive testing of drugs before their adoption, the vast statistical studies that follow-up on the effects of particular new treatments are both derived from this one oath. Yet today there are many examples of social systems intervention based on such a tiny amount of understanding and follow-up that they cause human systems immense, irreparable harm. Consider the example of Mao and China. Consider the many laws and policies imposed in America by lawyers who know how to write laws into words but apparently know nothing at all about complex systems dynamics. Interventions designed by systems scientists are not based on much better evidence. Indeed, any one of us who attempts social system intervention should try to study the medical tool analogy very seriously and be humbled by our own professional oath... DO NO HARM.

5. "TOOL" THREE: An Electronic MultiDimensional Matrix Builder™

The third tool combines the rapid automation and vast memory of computers with the special advantages of general morphology to enable easier graphic tracking and use of systems concepts and applications-based systems analysis. Its superiority in juxtaposing many different variables in new ways makes it useful as a "thinking" and "discovery" tool.

5.1. The Need for Mapping of Cross-Impacts Among Multiple Parameters

Figure Six shows a conventional two-dimensional matrix used by many professions to help map cross-impacts between individual items in two lists of variables. For example, in landscape architecture the horizontal set of "columns" might be represented by different parameters of temperature for a site(such as elevation, slope, shading, solar incidence, etc.). The vertical set of "rows" might be represented by a quite different set of variables such as the heat conductance of different building materials or different architectural structures. Each square as an intersect would then hold a unique comparison between just two variables. Using such a matrix systematically results in a very comprehensive analysis of a wide range of possibilities for that particular site, and more ideas for a site design than if the detailed comparison had not been carried out. We have used a similar comparison to explore and discover potential "case studies" for our Integrated Science General Education(ISGE) program(also the subject of another presentation at this conference). In Table Three, the horizontal set of columns represented each of the seven sciences covered in the ISGE program and the vertical set of columns represented the twelve different Integrative Themes(systems processes) used to synthesize the scientific material. Each of the (7 × 12) eighty-four squares(intersections) thus created are defined by two variables, namely, the examples in any one science for any one of the systems processes. In this way, the investigator is required to regard all possible combinations in a guided comprehensive study. In this early version of the ISGE chart of possible case studies, each case study is represented by only the barest of phrases, otherwise it would not fit into the small space. Listed within many of the intersections(squares) are even more than one case study title. Each case study captured in a phrase is a scientific phenomena one science that also exemplifies one of the systems processes. Hundreds of case studies were identified by this method. Reading down any one column gives you a range of particular case studies for several systems processes in any one science. Reading across any one row gives you the range of diversity of examples of cycling(or one systems process) across seven natural sciences, namely, astronomy, physics, geology, chemistry, biology, computer science, and mathematics. 2D matrices are also used in many spreadsheet-based application programs and for studying systems dynamics using vector calculus, but these utilizations emphasize numeric accuracy more than the use of matrices cited here as a thinking and discovery tool.

But whatever the specific topical area or field of usage, matrices force workers to compare a wider range of variables systematically than might be considered if the technique were not used. If the axes are properly designed, few potential interactions are missed. To illustrate the practical utility of the technique, we used a matrix wherein the two axes were both the same list of isomorphies shown in Table One to generate the previously described tool, the Linkage Proposition Systems Model(LPSM). Surely we discovered more possible "linkage propositions" that we would have otherwise by considering every possible impact of one isomorphy with all of the others.

5.2. A Three-Dimensional, "Virtual" Cube for Visual Comparisons

While useful for comparing two sets of variables, the matrix does not allow state by state comparison of more than two variables. However, simply pulling out the planar matrix to three dimensions(shown in animations at this conference) results in a 3D cube that then allows for specific comparisons among all possible combinations of three variables. Figure Seven shows such a cube using our computer graphics. We have used such a cube in designing environmental education programs. On the "X" axis we placed a logical taxonomy of systems processes. On the "Y" axis we placed a taxonomy of environmental subsystems. On the "Z" axis we placed a logical taxonomy of environmental problems. Each cube inside the master comparison cube was defined by three parameters and asked the worker to discover a three-way relationship or influence between that systems process, that environmental subsystem, and that environmental problem. Using this discipline and guide, many more logical comparisons would be made by investigators than if the task was attempted without such a tool. That is why we call it a thinking and discovery tool. Furthermore, entire classes of comparison are covered systematically by this method. For example, any plane in the cube covers all of the possible relationships between one systems process, say feedback, and its use or disuse in all environmental subsystems and all environmental problems, each taken as a class.

5.3. Key Parameters Determine the Multiple Axes of A "Virtual" Computerized Polygon

In our early studies, we began to computerize this method to help keep track of the many comparisons and to help manipulate the cube. It was hard for mere human minds to follow 3D comparisons. However, systems scientists recognize that for many real systems there are many more variables than just three and this greatly overloads our limited human ability to keep track of and manipulate the compared information. The computerization we were attempting for the 3D cube was fortuitously helpful in this case because humans cannot even see above the dimension three. Yet hypercubes are four-dimensional(also shown at the conference presentation). Yet even a hypercube that we can't see would only be able to track four-variable systems of comparison. Using the computer to keep track of, not an interactive graphic, but rather a "multidimensional matrix", allows it to put in, keep track of, and manipulate a virtual imaginary polygon of comparisons allowing more than four variables to be used in discovery. Please see Figure Eight for a fanciful representation of this idea. The burden on human input and awareness is immensely increased in this case. There are so many variables and intersections to consider that only very large numbers of investigators in close communication could even attempt to use a virtual polygon as a multidimensional matrix. That is why some of the tools mentioned here might be more functional in Asian society where larger numbers of colleagues might agree to work more cooperatively for longer periods than is likely elsewhere. Such dedication and loyalty are required to make multidimensional comparison matrices possible. We are trying to complete work on a completely computerized tool called the Multidimensional Matrix Builder(MMB) to enable others to construct such societies of effort in the future.

5.4. The Forgotten, But Very Valuable Techniques of General Morphology

We have resurrected a little-known method, used by great discoverers from Newton to the late Fritz Zwicky of Cal-Tech, to include as part of the MMB tool. Zwicky is the person most responsible for collecting and describing this previously unspecified tool. He named the loose alliance of techniques "General Morphology"(GM) and wrote a book and several papers describing how to use it to solve or explore a wide range of basic science and engineering problems [49][50]. He also used the technique during WWII to predict 576 different and unique propulsive power plants and propellants. Only 5 of those that he predicted de novo were the subject of engineering efforts at that time. His addition of 571 new possibilities attests to the creative planning power of the techniques of General Morphology. Side effects of that effort were the issuing of numerous U.S. Patents to Zwicky, the foundation of the world-famous Jet Propulsion Labs(JPL), and beginnings of the Aerojet-General Corporation. Zwicky also used a two-dimensional matrix and general morphology to predict the precise characteristics of entities such as "neutron stars" and "clusters of galaxies" before they were found as physical entities. These are prodigious examples of scientific prediction and engineering creativity. My colleague, Albert G. Wilson, a student of Zwicky during this period, argues that General Morphology(GM) is clearly related to general systems approaches. As such, it is relevant to this paper and to thinking about problems like Korean reunification It should be obvious from what follows that general morphological techniques are adaptable to the multidimensional matrix builder(MMB) and extend its capabilities significantly.

The two most basic techniques of GM are use of a "morphological box" and "systematic field coverage". The morphological box is basically a GM application of the ideas behind a multidimensional matrix, in fact, similar terms, independently derived, are found in Zwicky's book. The technique of systematic field coverage generates the most productive set of variables for any of the axes of a 2D, 3D, or multi-dimensional matrix. It involves recognition of two guiding principles: (1) many objects form "families" of related variants, and (2) the variant members of these families can often be characterized by continuous sequences of characteristics, rather like continuous spectra. Additional principles that contribute to systematic field coverage involve the user's knowledge of, sensitivity to, and conscious invocation of the dual principles of the "history of the systems", and the "evolution of the system". The object of systematic field coverage is to focus on the most fundamental feature that varies across the objects and discover the underlying element of variation between them. The phrase includes the word "field" because once the most fundamental feature is discovered by inspection, it can be relentlessly applied until every possible variant is discovered. It appears to be a general rule for nature, that given vast amounts of time and energy, all possible variants occur. So this method is particularly useful when studying natural systems. Its use in social systems is still practical, however, because it can help humans envision alternatives they would not otherwise have suggested.

Some of the other accessory techniques used in GM are the following: (1) The Technique of Negation and Reconstruction, (2) The Technique of Opposites or Complementarity, (3) The Technique of the Extremes, (4) The Technique of Perfection and Imperfection, and (5) The Technique of Generalization. This paper must be too short to adequately explain these beyond one sentence each. The first takes a generally accepted "given" or "axiom" in a domain, and negates it, followed by a reconstruction of the other "givens" to see what changes it causes to the domain. Surprisingly, this sometimes leads to major breakthroughs. Consider what the negation of one of Euclid's axioms did. It gave birth to the vital field of non-Euclidean geometry. The second uses the universal concept of duality to envision the complementary state of any established state, especially if it has not been imagined yet. Since natural systems include many dualities at their most fundamental level, this strategy often leads to the discovery of what was formerly ignored. The third technique recognizes that many systems when pushed to extremes of a limited range of parameters or stability's, either emerge into new

systems or operate according to new mechanics. Either way, this extreme territory can be fertile for discovery or capital exploitation. The fourth technique adds value to imperfection, the partner of the two most often ignored. Sometimes imperfections are the pathway to greater stability's, as is the case in curing steel to greater levels of hardness, or doping some mixtures to achieve higher levels of standard performance characteristics. The last techniques refers to the broad view of a domain enabled by a morphological approach. It is the vista of alternatives and variants that gives the user the power to recognize new, previously undiscovered entities.

To these techniques advocated and explained by Zwicky, I would add all of the isomorphies and linkage propositions of the LPSM. They are very specific clues to the fundamental characteristics of the "field" of variants for any particular system, and are also specific instances that could be used for the Technique of Generalization.

These techniques appear deceptively simple. Their real power depends on their systematic implementation given a brilliant understanding of the particulars of the system studied, or a brilliant application of general systems concepts and processes. As a final proof of the utility of GM and the MMB, please note they were used not only to predict clustering of galaxies and the neutron star long before evidence existed for either, but the following great discoveries in science. (1) In the hands of Mendeleyeev a variant of GM was used to discover the periodic table(an especially excellent example of systematic field coverage and prediction of missing elements due to the trends established). (2) Faraday used some of the methods to discover variant aspects of the effects of the interaction of motion, magnetic fields, and electric current.

5.5. Using the Computerized MMB for Deep Analysis of Korean Reunification: What Are the Key Determining Systems Factors?

How might one apply these tools to the Korean Reunification problem? There are numerous possibilities. Due to the length of the paper we will suggest a couple of examples, recognizing the limits of our understanding of the problem and our reluctance to offer advice. Using the technique of opposites, one could form a multidimensional matrix matching "areas of surplus or excess" in South Korea with "areas of opposite need" in North Korea. As a specific example, there is a great excess of construction and earth moving machines of great cost in the South, and the exact opposite lack of such machines in the North. Construction of large public infrastructure projects in the North would put the excess into use that would pay off in the future. A third axis could be added that would describe alternative project classes using systematic field coverage for that domain, and a fourth axis would be a classification of the economic benefits from each set of alternatives. Another example would compare the excess of labor in the South, and even more in the North, with the absence of jobs to imagineer a series of industries that are not yet structured. As a specific example, the North has a great deal of mineral wealth lacked by the South(another complementarity), and job-producing corporations should be quickly initiated that would "grow" their capital and expansion by putting these minerals to use. The labor excess could also be joined to the construction machine excess to improve dams and reservoirs that would lessen the effects of nature(drought and flood) on the agriculture of the North. Clearly, there are many possibilities and exploring this "possibility space" would take the unique ability of the Koreans to work together over long time periods.

6. "TOOL" FOUR: Using Software Development Tools for Social Engineering

6.1. Analogies between Software Development and Human Social Evolution

This paper began with an analysis of the deplorable state of social systems design which is primarily left to legislators and bureaucrats that have little or no experience in how systems work best, or how they go wrong(systems pathology). Social systems design should be a conscious act of enabled social evolution, yet it is taboo to even think in these terms. Past attempts at designing societies, have been left to the wanderings of uninformed chance as a result of this nearly total lack of systems awareness and the taboo against social planning in general. There is no developed sense of testing and experimentation with social design alternatives. The malperformance of social systems is not connected to their redesign by feedback. There is a rigorous resistance to the "selection" aspect of social evolution even though the evolutionary feature of societies is undeniable.

In the medical analogy offered as Tool Two, we focused on systems pathology Software development is evolutionary. It requires many iterations of process and many small improvements.

6.2. Software Development Tools Useful for Improving Social Systems Engineering

As computer programs have become more complex and central to all modern societal functions, they are valued at much higher levels of economic value and a greater premium is placed on faster and more efficient software development. But as extensive as use of the software industry is, recent studies indicate that the vast majority of current software development is conducted in an undisciplined manner. The SEI-CMM(Software Engineering Institute-Capability Maturity Model), based out of Carnegie-Mellon University, has devised a classification system for program development of five stages. The first stage is called "initial" or "ad hoc". The vast majority of all software development organizations work at this level of maturity. It is characterized by individual effort where planning is virtually non-existent. The second stage is termed "repeatable" or "reproducible". This level of maturity engages sufficient planning to enable successes to be repeated. Virtually, 80% of software development organizations operate at these two most primitive levels of maturity. The third stage of maturity is called "defined". This type of software development is characterized by the existence of a tangible plan of design, development, and testing used consistently across the many individuals of a large organization. Possibly 15% of software development organizations are at this level of maturity. The fourth stage of maturity is termed "managed", and is characterized by the comprehensive management and measurement of the software development cycle throughout the organization. The fifth stage is called "optimizing" where the results of the management and measurement are tightly coupled(fedback) to the redesign of the entire software development process as well as the institutional goals and strategies. Only 2% to 3% of organizations reach this stage. It is our contention that the various maturity levels defined for software development are useful in assessing the process of social systems design and development for the first time, since this assessment is not routinely carried out.

The multitude of experiences with the software development cycle could also be used to improve the social systems development cycle. These are: precise definition of requirements and performance specifications, design, construction, and testing. Please note that legislatures and executive branches of government do not use these stages or phases at all in the current design of social systems. Here is another example of potential use of software development for improving social systems development. The "patterns" evident in architecture popularized by Christopher Alexander improved and codified architectural design. Software developers used analogous procedures to look for and recognize repeating patterns in constructing software leading to a new design method. We maintain that social systems design could be improved and codified by developing similar methods of pattern recognition and implementation. We maintain that embedding any of these three software development methods in social systems design would improve its performance and reduce human misery.

6.3. Use of Software Development Tools at Our Institute for Design of Educational Innovation

We are currently using SDP tools to help improve the educational process. At this conference we presented the extensive computerized multimedia lessons for the Integrated Science General Education(ISGE) program. The act of writing the software that drives the ISGE lessons is an act of social evolution. It specifies what resources are presented to the students, loosely guides their actions, and does both for the purpose of achieving a specified learning outcome. Such learning outcomes are, in fact, individual events of personal evolution. The guidance of an entire class, and over the years, an entire cohort of students, approaches social evolution.

But our ISGE software also measures many variables about each student learner as the student is learning. These measures are collected, organized, and analyzed for each individual, the class as a whole, and for an entire series of classes. The availability of these instant measures of levels of performance of not only the individual, but the software that is aiding them, provides us with a unique opportunity. If we could tightly couple (bind) (connect) the data on the efficacy of the software with the redesign of the software, we could shorten the time needed to make improvements, and vastly increase the probability of improvements occurring that are responsive to the needs and opportunities. Figures Nine shows our ISGE software design project without these tightly coupled feedback loops to the design process. This is the way we suggest most social systems engineering occurs. Figure Ten shows our ISGE process with the addition of increased feedback directly to the design process. We have adapted commercially available software development software(such as Rational Rose™, Requisite Pro™) to help us achieve both the goal of better feedback to the design process and raising the level of software development maturity at the same time. We believe both methods can be used effectively on social systems design projects in such a way that it revolutionizes that process.

6.4. Relevance to Korean Unification Goals and Processes

Again, we are reluctant to offer suggestions to others, and plead forgiveness for our arrogance. The Confucian nature of Korean society provides an especially fertile domain for application of systematic software development ideas to the improvement of society. This is a society wherein the individual is much more amenable to honoring social rules and guidelines. The unification of the North and the South will be a time of great stress as well as opportunity. At these times, any society, but particularly the Korean people, would tend to come together and accept the need for studied change. If a systematic study of the outcomes of small social experiments conducted during the unstable transitional period were encoded in maxims that were fedback to the social institutions, there is a higher probability of their long-term contribution to improving that society. The large-scale and coordinated usage of the Linkage Proposition Systems Model(LPSM), the Multi-dimensional Matrix Builder(MMB), General Morphology(GM), and our suggested modification of Software Development Software(SDP) could assist in specification or imagineering of these improvements.

7. Key Limits to Human Influence on Systems Emergence: Applications to Korean Unification

Albert G. Wilson, mathematician and astronomer, and I concluded after many discussions of the mystery of systems emergence that humans probably had little influence over their own emergence. Despite the many tales of leaders and hero's changing the course of history, the nature of true emergence seemed to us to be insulated from direct human influence for several reasons. First, humans generally mistake in-level change and even chaotic rearrangements for emergence. Emergence requires a broad understanding of magnitudes and scales. It results in new levels of structure or function and creates new scales and magnitudes in the universe. Creatures without a broad understanding of levels across the universe cannot even perceive emergence. Second, the conditions for emergence arise by a bottom-up mechanism, not a top-down mechanism. Vast swarms of lower level parts must spontaneously give rise to the emergence due to some previously unused, but still inherent nature. Any one human cannot control enough of reality to cause an emergence. Third, emergence in complex systems, whether natural or social, seems to us to be more a function of "fields" and the tendencies enforced on participants by these "fields". But humans have a very poor set of tools for studying and understanding even those "fields" we have recognized, much less the many

"potential fields" that we are not even aware of at present. Fourth, part of the definition of emergence is that it cannot be predicted from simple addition of the features of the parts that contribute to it. Humans find it very difficult to follow broken chains of causality. We concluded that humans would serve emergence best by trying to indirectly promote conditions, which favored emergence rather than trying to cause a pre-determined emergence directly. This latter course requires a great deal of wisdom, patience, and foresight.

So the answer to the Korean reunification problem, like so many other current and past political integration challenges, may not so much result from one or a few humans causing the integration as much as many human beings cooperating to create fertile conditions in the many that favor the integration. The main contribution of a systems view of Korean reunification is to specify numerous favoring conditions in the manner attempted in this paper. Hopefully, we can increase dramatically our chances of discovering practical mechanisms that will change our world by using the four new "thinking" tools described.

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Table 1. Alphabetical List of Isomorphic Systems Mechanisms or Processes

1. Allometry Patterns
2. Anergic Mechanisms
3. Ashby's Conjecture(Requisite)
4. Attractors(Point, Periodic, Mixed)
5. Autopoiesis, Allopoiesis
6. Bifurcations
7. Boundary Conditions
8. Catastrophe Processes
9. Closed Systems
10. Competitive Processes
11. Cooperative Processes
12. Counterparity Mechanisms
13 Coupled Feedback Processes
14. Couplings
15. Cycles and Cycling
16. Decay Processes
17. Deutsch's & Dollo's Conjecture
18. Development Patterns & Laws
19. Dissipative Structures & Processes
20. Duality Mechanisms
21. Emergence Processes
22. Energy Flow Processes
23. Entropy
24. Equilibrium Processes
25. Ergodic Processes
26. Evolutionary Processes
27. Exclusion Principle
28. Feedback Processes
29. Feedforward Processes
30. Fiegenbaums Constant
31. Field Dynamics
32. Fractal Structure, Time, & Processes
33. Fragmentation Processes
34. Flows, Generic Rules
35. Growth Patterns & Laws
36. Hierarchical Structure & Process
37. Homeostatic Processes
38. Hypercycles
39. Input Mechanisms
40. Information Flow Processes
41. Integration Processes
42. Instability Mechanisms
43. Least action/Energy Principles
44. Lifestage Cycles
45. Limit Cycle Processes
46. Limits, Physical
47. Limits, Informational
48. Lotka-Volterra Substitutions
49. Lyapunov functions
50. Maximality Principles
51. Meta-Heterarchical Str & Processes
52. Minimization Principles
53. Morphodynamic Processes
54. Negative Entropy
55. Negative Feedback Mechanisms
56. Network Dynamics
57. Non-Equilibrium Thermodynamics
58. Open Systems
59. Oscillations
60. Output Processes
61. Periodic Processes
62. Phases
63. Plenitude, Priciple of
64. Positive Feedback Mechanisms
65. Potential Spaces or Fields
66. Power Spectrum of Physics
67. Replication-Recursive Mechanisms
68. Restructuring Rules
69. Self-Organizing Processes
70. Singularities

Table 1 cont.

71. Soliton Theory(long Waves)
72. Spin Processes
73. Stability Processes
74. States
75. Steady State Mechanisms
76. Strings, Generic Systems
77. Symmetry, Systems-Level
78. System Identification, Sub-, Super-
79. Taxonomy, Systems
80. Transgressive Equilibrium
81. Variation Mechanisms
82. Zipf's/Pareto's Conjecture

Table 2. Clusters of Systems Mechanisms for Simplification

1. Systems Definition

1) System Identification, Sub-, super-
2) Boundary Conditions
3) Closed Systems
4) Open Systems
5) Taxonomy, stystems

2. Systems Structure

1) Development Patterns & Laws
2) Hierarchical Structure & Process
3) States
4) Phases
5) Duality Mechanisms
6) Negative Entropy
7) Symmetry/Asymmetry, Systems-Level
8) Fractal Structure, Time, & Processes
9) Strings, Generic Systems

3. Systems Linkages

1) Generic Flow Rules
2) Couplings, Types of
3) Input Mechsnisms
4) Ouptut Processes
5) Energy Flow Processes
6) Information Flow Processes
7) Anergic Mechanisms
8) Synergistic Processes
9) Dissipative structures & Processes
10) Cooperative Processes
11) Competitive Processes
12) Network Dynamics
13) Transduction Mechanisms

4. Systems Maintenance (Short Term)

1) Stability Processes
2) Steady State Mechanisms
3) Feedback Processes
4) Negative Feedback Mechanisms
5) Coupled Feedback Processes
6) Equilibrium Processes
7) Homeostatic Processes
8) Feedforward Processes
9) Hypercycies
10) Non-Equilibrium Thermodynamics
11) Ashby's Conjecture(Requisite Variety)

5. Systems Behaviors

1) Equifinality & Mechanisms
2) Instability Mechanisms

Table 2 cont.

3) Cycies and Cyciing
4) Oscillations
5) Attractors (Point, Periodic, Mixed)
6) Limit Cycles
7) Bifurcations and Catastrophe's
8) Ergodic Processes
9) Lyapunov Functions
10) Periodic Processes
11) Soliton Theory (Long Waves)

6. Systems Transformations (Long-Term)
1) Positive Feedback Mechanisms
2) Variation Mechanisms
3) Restructuring Rules
4) Decay Processes
5) Catastrophe Processes
6) Second and Third-Order Cybernetics
7) Compiexification Mechanisms
8) Lotka-Voiterra Substitution Patterns
9) Transgressive Equilibrium
10) Evolutionary Processes

7. Systems Environment
1) Entropy
2) Least action/Least Energy
3) Principles
4) Limits, Physical
5) Limits, Informational
6) Maximality Principles
7) Minimization Principles
8) Potential Spaces
9) Pienitude, Principle of
10) Field Dynamics
11) Power spectrum of Physics

8. Systems Patterns or Trends
1) Allometry Patterns
2) Fragmentation Processes
3) Growth Patterns & Laws
4) Morphodynamic Processes
5) Lifestage Cycies
6) Zipf's/Pareto's Conjecture
7) Meta-Heterarchical Structure & Processes

9. Systems Oprigins
1) Counterparity Mechanisms
2) Autopoiesis, Allopoiesis
3) Integration Processes
4) Self-Organizing Processes
5) Emergence Processes
6) Deutsch's Conjecture; Dollo's Law

Table 3.

THEMES \ SCIENCES	ASTRONOMY	PHYSICS	CHEMISTRY	GEOLOGY	BIOLOGY	COMP SCI	MATHSTA
HIERARCH SCALES OF SIZE	galaxies; stars; planets; moons; ast.; cluster	families of sub-atomic particles; atomics str	elements; compounds; polymers; multimers	gelogic time hier; landsat to crystallog, hierarchy	organelles; cells; tiss, org.; org's; ecosystems	stepwise refinement; sub-program; sys, str.;	log scalles; metrics; nested equations
MODELING REALITY: CAUSES & CHAOS	chaos in planet orbits	turbulence in flows; chasos in snowflakes & faucets		chaos in weather sys	chaos in muscle & heartbeats	how the comp helps us "see" chaos	universal quantities in chaos
SYSTEM DYNAMIC'S & BOUNDS	gravity as action at a distance;			effects of asteroids on planets; green house offects	membranes of cells; the skin eco-ranges; interactions;	computer networking;	concepts of limits; fcn's as interaction
SELF-ORGZ ORIGINS & EMERGENCE	origins of the solar system; starbirth; cos heterogeneity		coacervates; hypercycles	volcanic isles mech's of orogeny;	autocatalysis of organelles; new species; macroevol;	artificial life games; pattern recognition;	

Table 3 cont.

SCIENCES / THEMES	ASTRONOMY	PHYSICS	CHEMISTRY	GEOLOGY	BIOLOGY	COMP SCI	MATHSTA
REGULATORY MECH AND FEEDBACKS	stellar feedbacks;	nuclear fission rxns;	end-product inhibition,	Gain & bio feedbacks to geo;	hormones; embryology; eco food wet;	program control statements;	computation explosion;
STABILITY & EQUILIBRIUM	Hertzprung-russell diagl stellar stabilities;	thermodynamic equilib; phys, stasis	palancing rxn equations;		dynamic equi librium MTS; homeostasis equilib in ecosystems;		math, of dynamic equilibrium;
CYCLES & OSCILLATIONS	galactic life cycle; stellar life cycle; osc illating cosmos	states of matter;	transitions; phase diagrams;	crustat recycling; biogeochemical; ice-age cycl.;	organism life cycles; species, ecosys life cycle	recursion loops in prog;	math. of oscillations;
DUALITY, SYMMET, GROUP TH.	binary stars; matter vs. anti-matter; asymmetry;	opposite spins; wabe-particle dual;	optical activity; and-charges; ana-catabol-ic cxns	dual forces in storms; crystal form symmetries;	complementarity in dana; gene info tran bilateral sym deuroneptides	duality in programming	group theor duality in algebraic sets; geom; & Poncelet

Table 3 cont.

SCIENCES / THEMES	ASTRONOMY	PHYSICS	CHEMISTRY	GEOLOGY	BIOLOGY	COMP SCI	MATHSTA
IIMITS, CONSERV, ON FLOWS	universal constants; anthropic principles	physical limits; entropy laws;	chemical information		biopolymers as info;	history of information theory; limits of computing	math of info theory;
INTERACT NETS & FIELD TH.	grabitational fields;		types & basis of chemical reactions;	multiple effects of CFCs	ecosystem structure; dev'tal gradients;		
FORM, PROPORTION & CHANGE	closed or open univ.?;	engineering allometry;			biological allometry; neural nets;		discovery of the calculus;
MECH OF VARIETY AND EVOLUTION			chem competition & selection;	punctuated equilibrium; Burgess shale;	discovery of evolution;	genetic computing algorithms;	how chance generates variety;

Table 4. A Collection of Systems-Based Reunification Propositions or Maxims

Caveats:	The text of the first paper in this series mentions specifics on the Korean reunification problem for each of these general Maxims without which they here sound so general they could be applied to any problem. They are collected here as a set of Maxims from general systems studies much like Sun-Tsu devised a set of general Maxims for warfare, or Machiavelli for maintaining the prince's power. In the paper's text we remind the reader that applying general Maxims to particular circumstances is as difficult as discovering the general Maxim in the first place. There are no simple or final answers for a problem as complex as Korean reunification, and these Maxims are meant to stimulate thinking, planning, and discussion. Finally, please remember that the text states clearly that these were meant to be applied as a full set and are weak if attempted singularly.
1. *Maxim*:	*Focus on improving the lowest levels of the hierarchy in North Korea to improve the total system for the longest term.*
2. *Maxim*:	*Discover empirical criteria for identification of the most naturally occurring improvement clusters (sectors) in North Korea.*
3. *Maxim*:	*Devise unique plans for each identified natural cluster in North Korea*
4. *Maxim*:	*To encourage integration of a new hierarchy, you must enable a new network of interactions within the infrastructure.*
5. *Maxim*:	*New hypercycles can only replace older hypercycles if the new hypercycle is orders of magnitude better or more efficient than the old.*
6. *Maxim*:	*Develop the basics of the No. Korean new social system as an improved network of hypercycles apart from the old No. Korean social system.*
7. *Maxim*:	*Extensive training and acclimation programs must be initiated before any particular natural No. Korean cluster is financed for assimilation, or So.-No. cluster for cooperation.*
8. *Maxim*:	*Identify and use the forces of each cluster or level of the natural hierarchical age pyramid to enhance participation of the whole population. This will require separate age-level analyses for South and North.*
9. *Maxim*:	*Human integrations require the accumulation of considerable "potential energy" as they must proceed opposite the natural tendency for fragmentation. They require maximum total systems planning to proceed at all and to be successful must establish a new order of interactions that transcend previous states. Otherwise decay will outstrip the planned integration.*

Table 4 cont.

10. *Maxim*:	***Study specific ways that socialist, anthropomorphic hypercycles can be altered to include fundamental natural systems processes.***
11. *Maxim*:	***Devise ways to transform every specific obstacle to integration into a promoter of integration by making it into a performance specification and reversing its effects.***
12. *Maxim*:	***To achieve the most stable and lasting unification, always seek to establish an integration using binding at the lowest levels of the social hierarchy.***
13. *Maxim*:	***Use all possible means of scholarship to expose and communicate widely the very poor systems design principles that typify current centrally planned economic systems(particularly inappropriate or missing + and – feedback loops).***
14. *Maxim*:	***Increase open communication between the two societies because this will unleash the natural negative feedback potential in the polity. A wide range of measures should be taken to help open communications provided the threat to the current power structure is deflected in clever ways using secrets from IF cycles of the past.***
15. *Maxim*:	***The effort for integration should be presented as emergence of a new type of system that transcends both the shortcomings of capitalist and socialist systems.***
16. *Maxim*:	***Motivate more will for reunification by estimating energy and economic savings and likely increases in quality of life for the people.***
17. *Maxim*:	***Identify and enhance all possible "attractions" between entities to be bound(at all levels, classes, and domains of both So. and No. Korean society).***
18. *Maxim*:	***Reduce the disruptive influence of the surrounding systems environment on the classes and types of anticipated bonding between entities(in the United Korean society).***
19. *Maxim*:	***Create bonding classes that balance the opposing needs for stability and change to allow for future adaptation and evolution of the bonded entities.***
20. *Maxim*:	***Identify "shared needs" due to incompleteness and create ways to fulfill that need that promote integration.***
21. *Maxim*:	***Create variants that mirror each other in overall bodyplan, but are stochastic variations of missing and extra parts of that bodyplan, a condition which promotes binding.***
22. *Maxim*:	***Promote every possible type of exchange being cautious to ensure that exchange occurs; one way flows result in the opposite of binding.***
23. *Maxim*:	***Create and clearly publicize the benefits that accrue to "parts" willing to be subsumed into the whole.***
24. *Maxim*:	***Be ready with a total systems plan for integration in case a "punctuated" or sudden decline occur in No. Korean stability.***
25. *Maxim*:	***Several total systems plans should be prepared each predicated on a different set of contingencies.***

Table 4 cont.

26. *Maxim*:	*Create plans economic sector by economic sector, population cluster by population cluster that can be shown to minimize total system investment per unit of productivity or unit of increase in quality of life (in won, energy, manpower, etc.).*
27. *Maxim*:	*For each economic sector or population cluster seek to establish the maximum number of connections with entities within the unified country and with sectors or clusters in other countries to achieve the maximum operating size of each sector or cluster.*
28. *Maxim*:	*The new No. Korean social system must be demonstrated to be much more productive and efficient than the old as regards the most numerous and lowest hierarchical levels of society before any attempt is made for it to replace the old.*

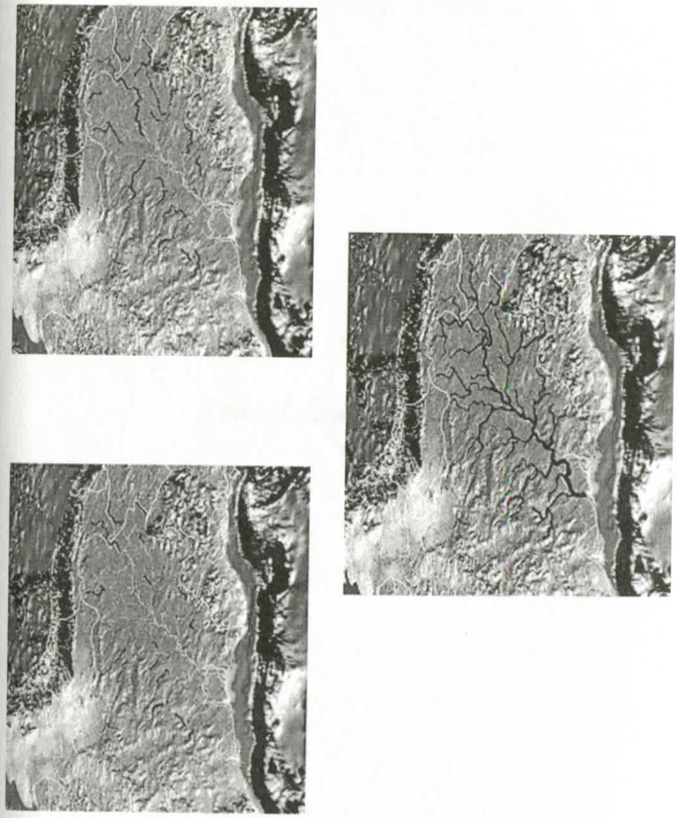


Figure One shows three intermediate stages in the growth of a tree as a graphic metaphor of the systems process of fragmentation.

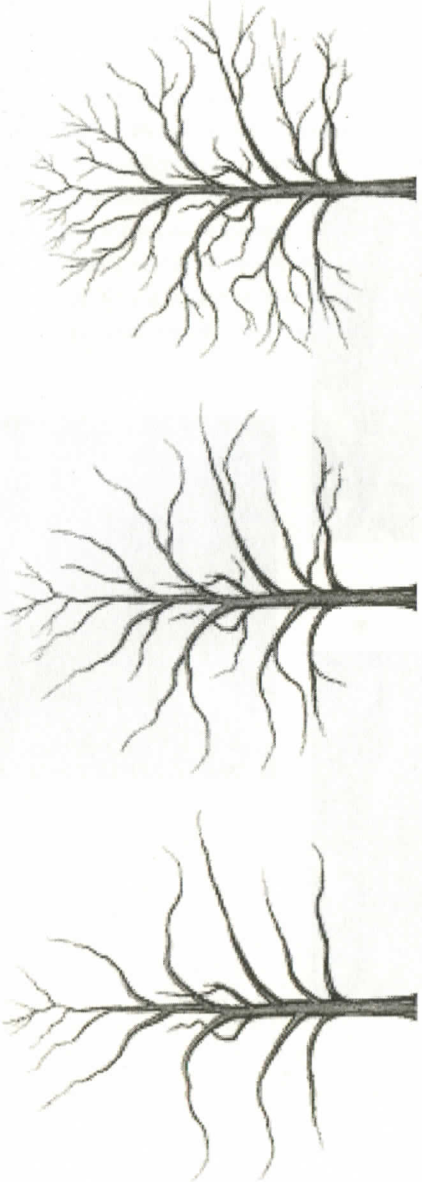


Figure Two shows three stages in the confluence of a river as a graphic metaphor of the systems process of integration.

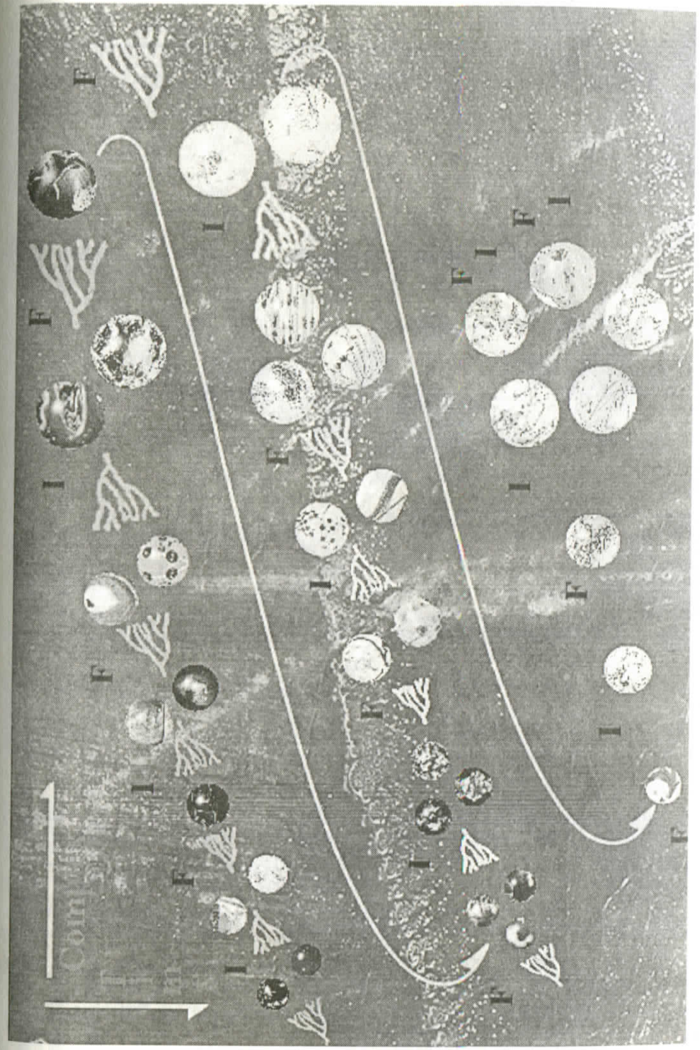


Figure Three is a non-interactive snapshot of the originally interactive, multimedia graphic shown at the conference which catches 13 billion years of I & F events in a single picture. Shown are a series of 10 selected integration events and 10 selected fragmentation events arranged in an unbroken series of successive origins.

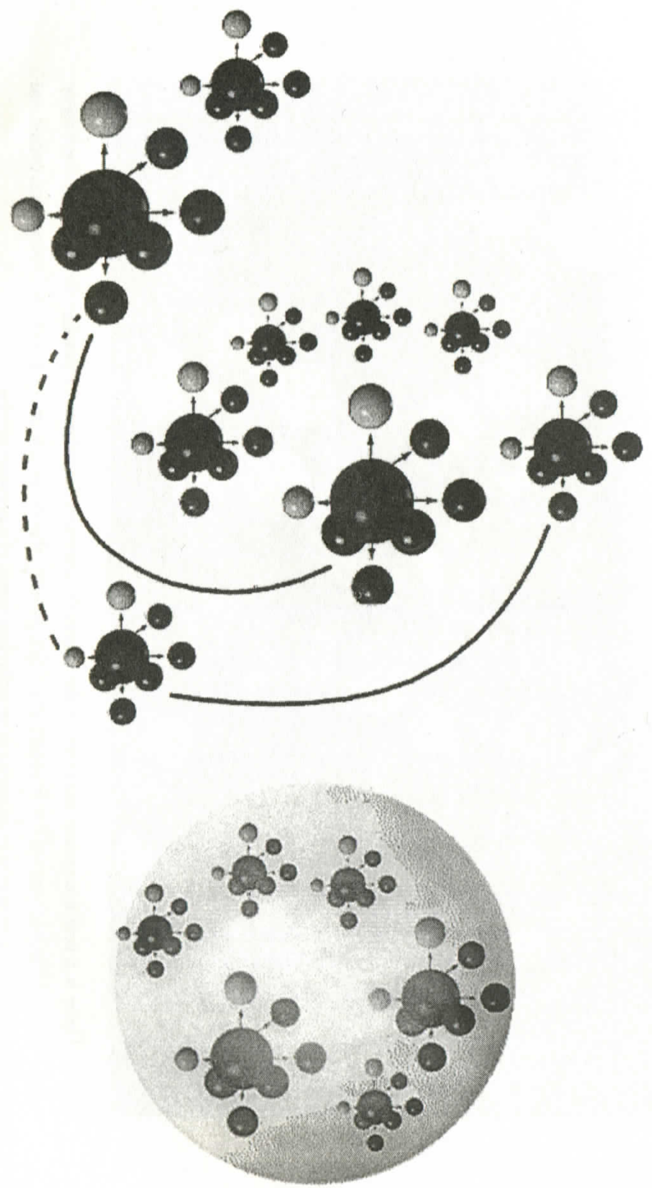
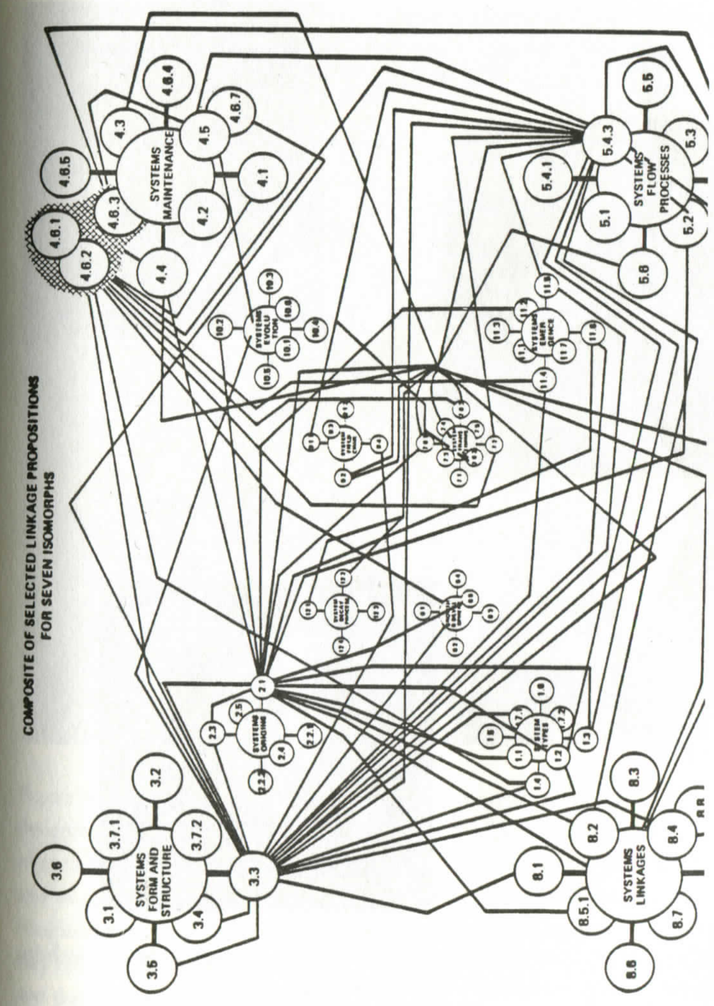
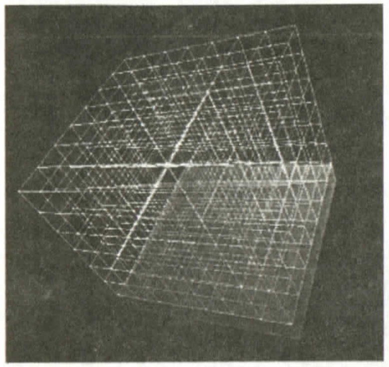
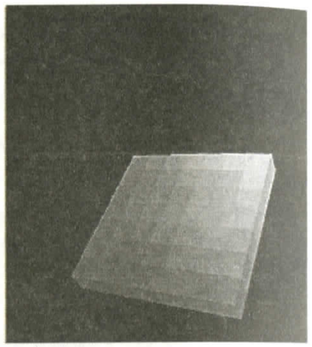


Figure Four shows a computerized graphic interpretation of the LPSM rendered in a form that not only delivers the LPSM, but also organizes it in nine stages of the general systems life cycle with the associated isomorphies (small bubbles) that cause the stage. Within each bubble are sub-bubbles of sub-processes.



Each of the lines shown in Figure Five is a SLP. Clicking on any line then would bring up that linkage proposition statement and a double click would lead to its information from the LPSM database. This graphic then becomes a tool to use in exploring the incredible detail behind the LPSM.





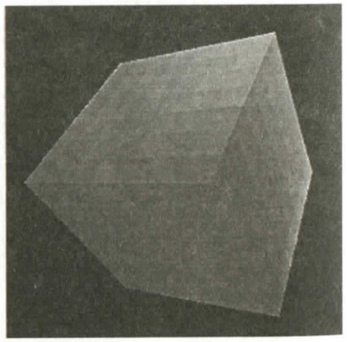


Figure Six shows a conventional two-dimensional matrix used by many professions to help map cross-impacts between individual items in two lists of variables.

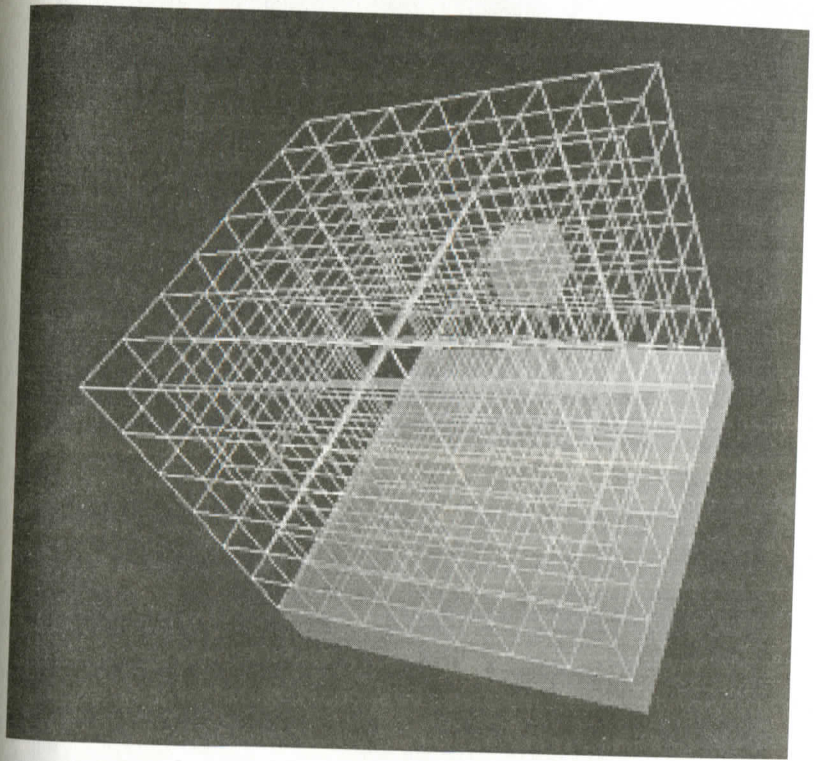


Figure Seven shows such a cube using our computer graphics. We have used such a cube in designing environmental education programs. On the "X" axis we placed a logical taxonomy of systems. On the "Y" axis we placed a taxonomy of environmental subsystems. On the "Z" axis we placed a logical taxonomy of environmental problems. Each cube inside the master comparison cube was defined by three parameters and asked the worker to discover a three-way relationship or influence between that systems process, that environmental subsystem, and that environmental problem.

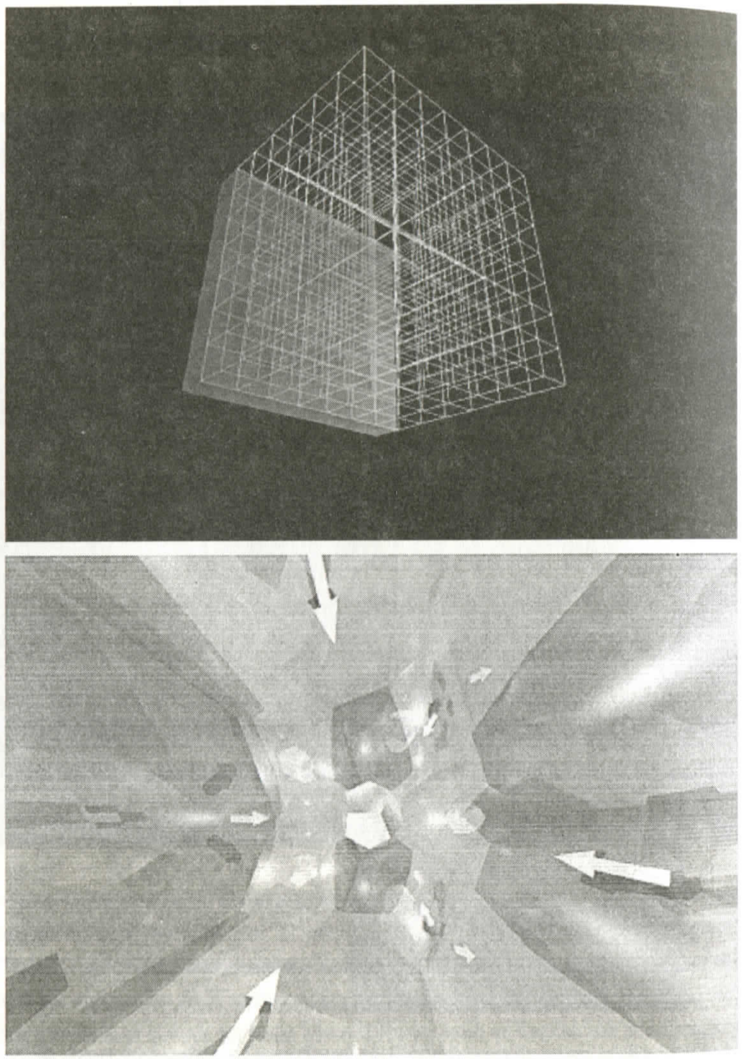


Figure Eight is a fanciful graphic representation of the multidimensional box idea. Using the computer to keep track of, not an interactive graphic, but rather a "multidimensional matrix", allows it to put in, keep track of, and manipulate a virtual imaginary polygon of comparisons allowing more than four variables to be used in discovery.

Changing Political Economy in Northeast Asia and Inter-Korean Relations

Kwan-Hee Hong
Research Fellow, Korea Institute for National Unification

1. Introduction: Politics and Economics in International Relations

The interaction of politics and economics is one of the old themes in the study of international relations. Two subjects are interwovenly related to each other in many ways. Today, realists' view that sees the primacy of the nation-state (vis-a-vis international law or morality) as a principal element in international relations still exerts a powerful influence on thinking of this field. At the same time, economics—represented by the concept of the market—is also playing an important role of organizing the international order. Two opposed forms of social organization, the modern state and the market, which are based on the two different categories, have evolved together to shape modern world order.

In their respective characteristics, the state is based on the concepts of territoriality and exclusiveness in the legitimate use of force, whereas the market is based on the concept of functional integration pursuing economic interests. The logic of the market is to "locate economic activities where they are most productive and profitable".[1] Thus, for the market, the elimination of all political obstacles to

1) Joan Edelman Spero, *The Politics of International Economic Relations*(St. Martin's Press: New York, 1985), p. 1.