The Cognition Partition: Toward the Horizons College

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The cognition partition is the name given to the division of learning into two domains: the domain of normality and the domain of complexity. Requirements for learing differ vastly between these two domains. The traditional division of learning is based on dividing by topical area, i.e., by discipline; but such a division is unsatisfactory because it implicitly embeds the assumption that there is no cognitive distinction to be made among the disciplines insofar as learning is concerned. Examination of subject matter through the lens of the recent discovery of metrics of complexity makes very clear that many of the disciplines, and especially the social science disciplines, require reorganization for learning, based upon what has been learned about the cognitive aspects of complexity. This requires implementation of the cognition partition, using principles from systems science. Implementation is best accomplished through a dedicated doctoral program in a new university appendage called the Horizons College, which is dedicated to systems design. This will accomplish desirable social objectives while expanding learning opportunities.

Keywords: cognition partition; horizons college; systems design, complexity matrix.

1 Introduction

There is an enculturated momentum to institutionalized learning. This momentum sustains long-established modes, applying them indiscriminately to subject matter. It is buttressed by mutually-supportive functional, topical, and temporal institutional structure. If attempts are made to break away along one axis, forces are activated along the other two to restore the system to its tight equilibrium.

Functional Structure by Organizational Chart. Virtually all universities are organized into colleges, schools, and departments, each zealously guarding its boundaries.

Topical Structure by Faculty. The departmental offerings are arranged into courses, and the individual faculty member zealously guards the proprietary courses.

Temporal Structure by Activity Sequence. Not only does this momentum apply to the continuing functional organization and minimal reorganization and to the arrangement of learning of subject matter; but it applies also to the sequencing of activity. So there is a parade of semester after semester, or quarter after quarter, commencement after commencement, with never a thought that there might be much to gain by a year of learning through interactive institutional redesign.

The Integrated Impact of the Multidimensional Institutional Structure. Taken together, this three-dimensional equilibrated space acts like a kind of educational Berlin Wall against which whatever forces of change may arise, encouraging them to falter and die.

"Physician, Heal Thyself". Ironically, the very institution whose structure resists macro-change magnificently is in the business of discovering the reasons why change in that institution is necessary. The same rule of personal advancement, known lovingly as "publish or perish", forces constant research and publication and re-examination of what has been done, with the inevitable statistical result that some small percentage of what is published turns out to be very revealing concerning the possibilities of improving both the learning environment and the quality of what is learned. Sooner or later some of what is learned can be aggregated into what amounts to a prescription for beneficial redesign of the institution itself.

The Irresolute Culture and the Tack-On: Industrial Parallels. There is something about cultural change that is independent of type of institution. In some respects, the university has its parallel in the large corporation. Two instances where large corporations have sought to introduce change that involved cultural issues come to mind. When IBM^{TM} sought to enter the personal computer business, the company set up a separate entity with different rules, in order to avoid the bureaucracy which it felt was better suited to maintenance of ongoing business than to supporting innovation in a new enterprise. When General Motors sought to make a splash in the small car business, it set up a separate entity with different rules to produce the Saturn^{TM}, for the same reasons. When an organizational culture has evolved in such a way as to sustain itself against all kinds of external forces, yet finds that it is vital to accommodate to a new situation, it is vulnerable to change at the boundary by appending a new entity, with the thought that ultimately it can be absorbed into the larger organization. I will discuss the cognition partition in more detail and then describe the proposed addition to higher education that will offer the means of gradually overcoming the cultural momentum that presently defies all attempts to introduce the cognition partition into higher education.

1.1 Discovering the Two Domains

In recent years, evidence has been uncovered, both theoretical and empirical, mutually supportive, that a strong distinction must be made between the domain of normality and the domain of complexity. This distinction is cognitive in nature, having to do with the joint physiological, psychological, and sociological makeup of the human being. It cannot be understood by looking away from the human being. There is essentially nothing arguable about the distinction, as those who choose to look into the matter will discover; because the results are replicable. The distinction to be made is called the "cognition partition", and it refers specifically to the act of dividing subject matter on the basis of complexity metrics. The two domains have been discovered by focusing upon one of them: the domain of complexity. The story of how this focusing came about has been told in historical detail [1]. For full understanding of what is to follow, the reader will do well to read this history. Salient, and distinguishing, aspects of the domain of complexity are these:

- This domain is a cognitive domain.
- This domain hosts many problematic situations; i.e., situations that no one understands, butwhich are recognized as problematic by a group of interested individuals, at least some of whichhave partial understanding of the situation.
- When given the opportunity to do so, the group can describe the situation by writing numerousproblem statements ("component problems") that are characteristic of the problematic situation.
- The viewpoints of the individuals with partial understanding as to the relative importance of the component problems are virtually uncorrelated this being described by the term "Spreadthink" [2].
- The language used to describe the situation is invariably and obviously (to all) highly defective, and can only become suitably discursive after participation in well-facilitated group processes that are defined to enable linguistic enhancement [3].
- When given the opportunity to do so, and given sufficient computer assistance in doing so, the group can structure the problematic situation in several valuable,mutually-supportive ways [4].
- Structuring yields insight not possible in any other way.

- Structuring produces genuine consensus not achievable in any other way.
- Structuring produces logical consistency not achievable in any other way [4].
- Structuring produces consensus designs not achievable in any other way.
- Structuring enables computation of a variety of metrics of complexity [4, 5].
- Evaluated metrics demonstrate unequivocally the presence of complexity, and enable interpretation of the requirement for the cognition partition by tying the values of the metrics to wellestablished and replicable empirical research from the behavioral sciences.
- Evaluated metrics of complexity enable alternative designs to be compared, which lend insights that facilitate making choices among competing system design concepts [6].

1.2 Complexity Metrics

A variety of metrics of complexity have been set forth in the literature. Dividing subject matter on the basis of these metrics will generally be facilitated by using several of them in conjunction. But to simplify the argument in the present paper, only one metric will be discussed: The Aristotle Index [5]. As might be suspected, since the subject of complexity is involved, its measurement involves some erudition. While the discussion has been given in great detail in the reference just cited, the essential assumptions will be given here. Aristotle's syllogism being a 3-statement format, imagine now that one could extend this syllogism format by interconnecting many syllogisms to form a syllogistic web of relationships. Suppose that what was being connected was a set of problem statements, all about some common situation, and that the syllogisms all expressed conditions about how these problems were mutually related. Now suppose that you could count the number of syllogisms that were interconnected in this web and divide the number by 10. To be specific, suppose you had 300 syllogisms interconnected, and then divided by 10.You would then have the number 30, *this number would be the Aristotle Index AI for the particular data given.*

As explained in detail in the references, the Aristotle Index value of 1 forms a border between the domain of normality and the domain of complexity. Any value of AI above 1 places the situation in the domain of complexity. In numerous situations encountered over the past few decades, the value of AI has always been well above 1.

This offers one reasonably good way to determine whether a topic to be learned lies in the domain of normality or the domain of complexity.

Also shown in the references are various other indexes of complexity which, taken together fully establish the requirement for the cognition partition.

1.3 Problem Orientation vs Situation Orientation

It is common in higher education and in many application fields to speak of "problem solving". In the domain of complexity, it is typical to find collections of interacting problems. This is why one typically finds networks of syllogisms when studying the interaction among problems; and why "problem-solving" is a cultural negative to be reserved for very late in the process when the cognition partition is involved. The word "situation" is highly useful to refer to a topic involving a collection of interacting problems.

Suppose, for example, a single university department chose to re-invent its discipline, having become convinced that its subject matter was appropriate for the cognition partition. How might it proceed?

One way to do so has been tested repeatedly over the past few decades. It begins with "problemization". I have described this [4] emphasizing Rabinows summary of Foucaults work. When it is done, the department will see the problems that its faculty can think of, and clarification of the language in which these problems are described. Moreover, the faculty will have a "problematique", consisting of a portrait of how these problems are mutually related, by means of an "aggravation" relationship.

Computer Usage. the problematique, being a structure that involves numerous syllogisms in a tight logical pattern, cannot be reliably constructed without computer help. The computer program used to construct the problematique is called "Interpretive Structural Modeling" [7]. It is an interactive program, based in De Morgan's theory of relations (1847). It queries the group as to how one problem relates to another, waits for discussion and voting, and continues until the structural details are in hand, then computes the structural details. As an example, reported in 1976, when the faculty of the systems science department at the City University studied its own program, the faculty were quite surprised to learn something significant about their views that they had not known. They were research-oriented by nature, a finding of self-discovery, possible when systematic conversation takes place to structure a problematic situation that lies in the domain of complexity. A similar self-learning situation with relatively low values of metrics was reported by Roy Smith in working with the Redemptorists in England in a study of their church activities [5]. Deep conversation uncovers matters not found in ordinary discussion. Deep conversation uncovers relationships that are not found, unless sought at the level of detail which is characteristic of the problematique and the Aristotle Index.

Extending the Departmental Scope. It has often been said that higher education exists to educate students to think critically. Unfortunately, this education seems to have the effect of tending to immobilize society, since everyone can criticize and few seem to be able to venture into a design mode. In a design mode, one sometimes finds it necessary to choose the least undesirable from a set of undesirable possibilities. But if that cannot be done because of inability to act, a society may end up with the worst of all choices which is doing nothing while things deteriorate. The same processes that are used in problemization can be used for design. Once the problemization is finished, options and optionatiques can be produced, again with computer help. Again, these processes are fully described in the literature. Metrics of complexity can be developed and different design possibilities can be compared for relative complexity.

1.4 Horizons College in System Design at the University Doctoral Level

Many executives who manage large corporations, or who occupy high level positions in national or state governments, have demonstrated repeatedly their incapability to cope with large-system emergencies. Yet those who act as spokespersons for higher education seem to be incapable of making any connection between such defective performances and the shortcomings of university education.

This connection should not be that difficult to make. Official higher-education documentation, consisting of goal statements and doctrine, not to say dogma, announces regularly that the primary goal of higher education, at least in the socalled “university college”, and in the liberal arts, is to develop critical reasoning, the analytical ability of the students. No mention is made of synthesis or design. But critical reasoning assumes the pinnacle of significance when it is applied in a design mode. Is this too difficult to absorb?

Research on human behavior has demonstrated clearly severe physiologicalbehavioral limitations on the intellectual performance of human beings – limitations that are absent from the assumptions underlying the processes of higher education, with the predictable effect that graduates absorb and reflect these same defective assumptions in their professional and public lives [4, 5]. The impact of these assumptions is highly visible in the gross mistakes that are made in conceiving and managing large public and private enterprises – mistakes that can be described as “incompetent system designs”.

The Horizons College in System Design at the doctoral level in higher education is proposed as a corrective measure, to develop individuals who are capable of doing more than analyzing and criticizing. The graduates of such a program will be capable of developing comprehensive insights into situations of substantial complexity, portraying these situations comprehensively, designing appropriate responses to them, developing responsible programs for their resolution, and managing the implementation of these programs. This capability will arise through programmed collaborative activity, assisted with extensively-tested computer software that amplifies (without biasing) human cognitive attributes.

The organization and design of the Horizons College is not speculative. In effect, it has already been tested outside the university environment. A principal challenge is to the university community itself – a question as to whether this community can, on the one hand, absorb such an entity and provide the architectural surroundings that are essential for its activities and displays and, on the other hand, provide the intellectual prerequisites to the rising students who will enter this College from within the university.

1.5 Teaching Critical Thinking

Despite the pervasive impact on all human beings everywhere of large systems of all kinds, higher education has never accepted system design as a key part of its mission. To illustrate the situation, quoting from Dr. Stephen H. Balch[1] in his presentation to the Select Committee of the Pennsylvania House of Representatives on November 9, 2005:

> *"...it has long been the consensus of higher educators that the core mission of colleges and universities, apart from research, is education. This was made clear in the founding statement of the American Association of University Professors (AAUP) in 1915, and more recently in a landmark brief submitted to the Supreme Court by the American Council on Education (ACE) and fifty-three other academic associations, including the AAUP, in the 2003 case of Gratz vs. Bollinger, which stresses that the purpose of education is to instill the capacity for independent thought."*

> *"Educators believe that developing the powers of analysis in this way is not merely one among many skills to be taught; it is the chief skill, because on it rests understanding and freedom. Socrates thought knowledge and freedom so essential, and so dependent on close reasoning, that the unexamined life is not worth living. The purpose of education, held the Stoics who carried his idea forward, is to confront the passivity, challenging the students mind to take charge of its own thought. To strengthen the ability to reason is to enable the student to determine what to believe, what to say, and what to do, rather than merely to parrot thoughts, words, and actions of convention, friends or family."*

The context for this presentation was to try to impress upon the Pennsylvania House of Re resentatives the importance of trying to fight the growing tendency of faculty in higher education to take positions of advocacy on political matters, as opposed to carrying out the "core mission", as outlined above. In offering Dr. Balch' quotation, I must take it out of that context and put it in another context, that of noting how well it avoids completely the context of system design. Moreover, as I will describe, it presumes that the individual can cope with the complexity inherent in todays society, merely as a consequence of experiencing degree programs in higher education – endowing higher education with a capability that it does not have. Educators must now begin to apply the very skills that they presume to develop in their graduates by asking themselves critically, and often, why their graduates have demonstrated in the public eye their lack of capability to cope with large system situations time after time. And if they do this often enough and with sufficient honesty, and in sufficient depth, perhaps what is proposed here will come to their studied attention.

[1]Dr. Balch is President of the National Association of Scholars, 221 W itherspoon Street, 2 Floor, Princeton, New Jersey 08542-3215. The Association burst upon the educational scene with a report demonstrating a longitudinal study showing how standards in higher education had deteriorated over a period of several decades. Since then it has begun publishing a journal and a newsletter.

1.6 Call to the Poets – First Call

Hamlet: Thrift, thrift, Horatio! The funeral bakedmeats did coldly furnish forth the marriage tables.

Would I had met my dearest foe in heaven Or ever I had seen that day,

Horatio! My father!- methinks

I see my father.

Horatio: O where, my lord?

Hamlet: In my mind's eye, Horatio.

So it is that Shakespeare speaks of the "mind's eye". And it is in the "mind's eye" that I choose to speak of the human decision-making apparatus. For if a choice is to be made among several possibilities, the mind's eye typically imagines these possibilities and decides on which will be chosen.

But it is the minds eye that is limited. As George A. Miller discovered [8], when the minds eye wishes to evoke items from memory, it is limited in immediate recall to the "magical number" seven plus or minus two. I have amplified this idea, showing that it can be limited to three plus or minus zero if the three interact [9]; for if there are four things and they interact, one has fifteen possibilities to be considered. Since I have discussed this in great detail elsewhere (Warfield, 2002), I won't belabor it here.

The mind's eye and the two eyes of the face have very different functions. The eyes of the face (please, allow me to call them the "feyes", pronounced "fies", since I have to speak of them endlessly) scan the external field of vision. The mind's eye (please allow me to call it the "meye", pronounced "my", since I have to speak of it endlessly) can scan what is in the brain or it can see what the feyes provide it.

This distinctive two-fold capacity of the meye must be understood, in order to understand what is involved in learning to design systems. The magical number seven is involved when a politician responds to a TV pundit on the air, because the meye has access only to the internal field of vision. But the same individual might actually be involved in a constructive design activity if allowed to take part in an adventurous workshop in which the feyes were providing an external field of vision to supplement the work of the politician's meye. To make this effective, the surrounding architecture would be chosen to display the full landscape of the situation, as will be explained.

Ordinary Decisions. Imagine that you are driving down a busy highway looking for an unfamiliar cross street. With the feyes and the meye working in conjunction, the former supplying information from the external field of vision to the meye, you are successful in making the turn. But what if you had to drive with all the windows and the windshield painted black, with only a one-inch square aperture on the windshield to see through, and heavy traffic all around? And what if you have a load of passengers urging you to drive faster to reach the destination on time? Under these conditions the meye is totally stressed. Being unable to get any significant information from the feyes, it is forced to rely on the internal field of vision, or perhaps on what comes in gratuitously through the ear. Very likely there will be a crash. This situation is analogous to what decision makers are encountering when they attempt to cope with complexity while trying to rely on the meye without help from the feyes. Ordinary decisions, made over and over again, condition human behavior to a certain mode; and this conditioning does little or nothing to prepare the individual for working in the domain of complexity.

1.7 Call to the Poets–Second Call

Tis with our judgments as our watches, none
Go just alike, yet each believes his own.

Alexander Pope wrote these lines early in the 18 century at age twenty. These lines describe what we have discovered over and over again in work with groups involving complexity [2], and which I titled "spreadthink". Each individual perceives different component problems of a situation to be the most important, no two people seeing situations comparably. *Thus whoever holds the reins of the decision-maker is almost certainly going to make a decision based on an incorrect perspective. The proximate cause of this error is lack of insight into how the component problems in a problematic situation interact, and how this interaction fluidly changes as poorly-thought-out actions are taken.*

Higher Education Is Successful! If a goal of higher education is to get people to think differently, that goal is achieved to perfection in situations involving complexity. If a measure of success would be to find that, in situations involving complexity, no leader could find acquiescence in what is proposed, and find only criticism, that goal also has been achieved. I coined the word "spreadthink" to describe this situation, and explained how anyone who doubts the concept could readily reproduce the findings.

Surely it is not a goal of the denizens of higher education to immobilize society. On the contrary, one might hope that a goal is to find a way to make it possible to enhance lifes experience.

In speaking to the Pennsylvania House, Dr. Balch was speaking against the high level of advocacy now found among faculty. Faculty are advocating social change blindly, lashing out, proposing "solutions" that will not work. What else would one expect from socially-sensitive people working in an organization that has bred and continues to breed, by choice, generations of critics? Is it to be expected that somehow a legislature can correct this condition, when the university itself has helped to create it e.g., by sensitizing whole generations to Karl Marx, but providing no constructive alternative?

Beyond Winston. Even Winston Churchill, who announced that democracy was not so great, but was just the best of what was available, might now be willing to suggest that even democracy could be improved if its practitioners could become more competent, and less inclined to flaunt their critical capacities, while demonstrating by their actions their constructive incompetence.

1.8 Systems Learning

Systems learning means to gain insight into the variety of problems that infect a situation, how these problems are interrelated, how they may be placed in categories for ease of reference, what options may be available for resolving the complexity that is inherent in a situation, and how the options may be interrelated in one or more proposed action strategies.

1.8.1 The Landscape of Systems Learning

The landscape of systems learning refers to a special field of vision, arrayed in such a way that the feyes can scan it over and over again, being commanded by meye, while meye, in turn, can, concurrently, draw on the internal field of vision when appropriate, all the while engaged in assimilating the insights required to expand on a comprehensive understanding of a situation that, initially, no one understood. Initially – that i –before a reasonably well-informed group of individuals engaged in a learning process to construct, with computer assistance, the components of the landscape of systems learning which, when arrayed in the external field of vision, provide the external supplement to meye that enables the kind of insight to be developed that no amount of typical university education can provide into a situation of substantial complexity.

The university education is very helpful. It simply is not sufficient, and can never be sufficient, in the absence of the structural components that are required to gain an understanding of the relationships among the components of the situation. This understanding will enable a truly deep and informed conversation to take place, which will eliminate the raucous, ill-informed, inevitable, unending, television nonsense that disgraces the living rooms of the nation today under the guise of "news" or "talk shows".

The landscape of systems learning means a large physical portrayal of four structures:

- the interrelationships among the component problems of a situation in the formof a problematique[2].
- the membership of the problems in categories in the form of a problems field
- the membership of the options in those same categories in the form of an options field.
- and the interrelationship among options in the form of an optionatique, showingwhich options, if elected and carried out, will help achieve other options.

All four of these portrayals are to be laid out at human scale to enable walkingviewing conversations for the purposes of discussion, evaluation, learning, and possible amendment.

Little systems learning takes place now. What are the reasons for the absence of systems learning?

Omissions. On the one hand, one may speak of causes of omission: because of the absence of architecture to house the landscape, the failure of practitioners to learn what is required to construct the landscape, and a very limited capability to manage the processes involved in landscape construction.

Commissions. On the other hand, one may speak of *causes of commission*:

- the accepted practices of developing glibness in verbal "problem-solving" ingrained by the educational system,
- the substitution of methods and theories for scientifically established practice,
- and the existence of many modestly-sized "paradigm villages" (they know who they are, and I will not identify them here, but I know who they are as well) whose "residents" enjoy social experiences, but do not necessarily go to pains to correlate their activities with the scientific method. Actually, they skip over science, like a child skips over a rope, when tripping over it, ignores it, and simply starts skipping all over again.

Impact of Paradigm Villages. Whatever benefits the paradigm villages may be producing, and they may (or may not) be producing many, they certainly dilute the possibilities for programs of the type described here if, for no other reasons, they confuse greatly both clients of education and educational administrators who, along with virtually all academic faculty, have no experience in system design and cannot make allocation decisions among many competing paradigm villages, each of which represents unique educational and social claims of merit.

[2] Warfield, J.N.(2002) , Understanding Complexity: Thought and Behavior, Palm Harbor, FL: AJAR Publishing Company. Numerous examples appear from a variety of applications.

1.8.2 Systems Science as the Base

The Horizons College will be founded in systems science . To make this feasible, a minimum set of resources[3] is essential. This set of resources can be inferred from the description of the largest of the several subsets, known as Interactive Management, which is thoroughly described in the literature, and which has been practiced on several continents for more than two decades. There is no university which has adopted the entire panoply of requirements, but several have enabled enough activity to transpire to allow ample empirical evidence of efficacy and character to be set forth. This activity, along with recorded activity in various industrial and government settings, has furnished an ample set of scholarly resources for those who wish to dig deeply into the essence of this science, and to learn precisely what is involved in this science.

The Distinctive Foundations. While the distinctive foundations have been described elsewhere, it is appropriate to discuss them in more detail in this essay, since the Horizons College must be clearly distinguished from other parts of the university, in order to make its mission evident, not only to justify allocation of resources to this College, but also to help persuade other parts of the university to assist in educating those students who will eventually come to the Horizons College.

A good system designer must have an excellent background in a diversity of fields, and especially must have a kind of maturity that can only come from what is often called a "liberal education". Just as I have said, in effect, that a liberal education is inadequate to produce system designers, I now assert that system designers will be myopic if they have not had a liberal education or, its equivalent, in life experiences, if such exists.

Systems science is founded by taking into account collectively the following key bases:

- **Creativity.** The creative human being.
- **Fallibility.** The fallible human being, subject to various behavioral pathologies, especially those identified or illustrated by empirical behavioral discoveries in the last half of the 20 century, e.g., [8, 10, 11, 12, 13, 14, 15, 16, 17, 18]. Please see Warfield, [4], Gallery in Appendix 1, for descriptions and pictures of most of these scholars.
- **Discursivity.** Discursivity that avoids linguistic pollution, roots out word bandits,emphasizes the avoidance of multiple meanings in the same context, and obliterates similar hobgoblins.
- **Computer Help With Logic.** Thought about thought, a legacy developingpainstakingly through more than two millennia, now made serviceable with thehelp of the modern digital computer, to structure the relationships among component problems and component options of difficult situations, thereby helping to develop the insights that cannot be gained by meye acting alone; enabling meye to gain the benefit of the field of vision that can be brought to bear, when the structural features of difficult situations can be tapped to supplement the associative and manipulative skills of meye which, otherwise, would be essentially helpless in the face of the complexity of the numerous situations that face leaders today.

Basing systems science in these foundations; and drawing on traditional academic subjects such as philosophy, logic, psychology, history, linguistics, computer science, and management, and remaining open to such other subjects as may be found to be relevant in the course of applied studies; one can hope to carve out for systems science a unique position in higher education. But for this to happen, the same principles and ideas that would be espoused in systems science should be applied to design the program that animates the Horizons College.

1.9 The Five-Point Horizons College Plan

The development of the Horizons College is not a simple project, and requires the coordinated achievement of a five-point plan, consisting of these major components:

[3] I have defined systems science in Warfield, J. N. [4], An Introduction to Systems Science, Singapore: World Scientific. In this definition, systems science is a collection of nested sub-sciences. The least of these in the set theory sense is the sub-science of description. It is contained in a subscience of design, which is contained in a sub-science of complexity. The latter is contained in a sub-science of action, and the four of these make up the bulk of systems science. Only two methodologies are learned. If others are required, they bubble up as requirements from the application of systems science, and are imported from specific sciences. For more information, one may consult the Preface of that book.

- Faculty Development Program,
- Entering Student Development Program,
- Architecture Design and Construction Program,
- Internal Learning Program Design,
- External Project Program Design,

Each of these will be described, in turn.

1.9.1 Faculty Development Plan

To understand the requirements of the Faculty Development Plan, it may help to recite a developmental occurrence of a novel organization from the early 1970s. An agreement was signed between the governments of the United States and Korea. The two presidents agreed that Korea would send troops to help with the Viet Nam war, if the USA would provide researchers from the Battelle Memorial Institute to set up a research institute in Korea to help that country industrialize. I can recite this story authentically, because one of the key principals, Charles Peet, had an office next door to mine at Battelle, and was a key person in helping set up the Korean Institute of Science and Technology (KIST).

Charles Peet, an Unsung Designer. We had several conversations about this situation. Charles was very knowledgeable in chemistry, solid state physics, and investments. For years he had been advising a family investment group.

Charles told me that, upon hearing of the potential establishment of KIST, a flood of academics applied to go back to their home countries, leaving their academic positions in the USA and elsewhere. Most of these were rejected. Charles wanted hard-headed Korean citizens, (largely expatriates) people who understood the importance of creative designs, and of investing in what would provide economic benefits to a country. To the best of my knowledge he interviewed personally many of the early staff of KIST, and only chose those who did not see as the main goal of KIST to provide a place where academics could be comfortable, do their private research, write papers, and retire gracefully with a pension. Charles chose both staff and fields of future research for KIST.

Korea Becomes an Industrial Powerhouse. Some years later, as history records, Korea became an electronics powerhouse. Not only did it develop its electronics industry in competition with Japan, but was able to parlay that development into the automobile industry. Moreover, it was able to do contract research for other Asian countries, and to help establish in Korean universities research activities that would support the industrial development of the country. (When I went to Ghana as an adviser some years later, I advised the scientific establishment to hire the former President of KIST to come there and write a program for the scientific development of Ghana, which they did).

Faculty Selection. Since there is no established Horizons College, and no faculty with the kind of background needed for such a College, it is advisable to select and nurture the development of a faculty, much along the same philosophical lines as was applied in the development of KIST.

The most fundamental aim of the Horizons College is to fill a critical gap in higher education, i.e., to develop people who are competent in design of large systems in the face of complexity: problematic situations that no one understands. In such situations, the only way that progress can be made is to bring together people who have partial understanding, and to apply systems science to help them integrate what they know, then interpret their products as a service for them. In this way the insight is developed to design and implement ameliorative, corrective measures for the well–being of whatever organization or society is involved. This kind of task requires the most sensitive and competent individuals who, on the one hand, understand what it means to serve, and who, on the other hand, are not willing to tolerate the self – serving authoritarian personality of the know – it – all who does not understand what is required to make progress in an area of mass ignorance.

The saving grace in this is that there is a wide vista of educated people from whom to draw, and one can speculate that there is a sub-population who have been waiting for this type of opportunity. Since experience shows that such people have arisen (and there are a number of them identified in my 2006 book, coming from different locations around the globe), it should not be hard to suppose that a responsible recruiting effort will draw in a small core faculty which can be augmented later as required. Probably a single semester would suffice for this faculty to flesh out the other components of the Horizons College plan and to work out details as they arise.

1.9.2 Student Development Plan

Entering students must be chosen with the same or even greater care than the faculty. There is some, but not a great deal of experience to draw on with an entering student body for a demanding program of the type to be offered here. The principal challenge is one of connecting with other departments inside and outside the institution to assess potential students, to make the program known, and to locate possible sources of student support. The faculty will come first, and will have to produce the student development plan as one of their first collective tasks.

1.9.3 Architecture Design and Construction Program

One of the unique features of the Horizons College is the space required for the landscape displays.

Drawing on experience. The most direct source of experience on this lies in two individuals: Dr. Scott M. Staley of the Ford Motor Company, who has worked with architects to develop a plan for an architecture, and Dr. Henry Alberts, who has used space at the Defense Systems Management College over a five–year period, in which he worked with more than 300 defense program managers, carrying out the kind of work that would be done in the Horizons College.

1.9.4 Internal Program Design

The internal program design would largely involve three components.

Course selection, would be relatively easy, with many of the courses to be offered from other parts of the university, chosen to satisfy many of the aspects of systems science described earlier in this paper.

Faculty associate selection, would involve faculty from other parts of the university serving as associates, based upon their volunteer interests in the program of the Horizons College and, if desired, identifying projects for the next component.

Project selection, would involve projects being chosen from internal sources to assist parts of the university in organizing their curricula, or their strategic planning or to assist them in organizing their doctoral research programs, or administrative programs if desired. If there is little or no demand for such assistance (there has been demand in some institutions in England and Mexico), only internal teaching projects can be used in preparation for the conduct of external projects. These can be similar to student projects reported in the literature.

1.9.5 External Program Design

The external program design is the most important part of the program of the Horizons College, because it is in this program that the quality of the College will be tested. This program will involve working with outside organizations, public and private, identifying their problematic situations, and bringing their representatives to the College, where they will become actors in resolving their own situations with the assistance of the faculty of the College. This will involve the following component activities:

- Client selection
- Project definition
- Project selection
- Workshop management
- Report production
- Case study publication

The case study preparation will be the principal requirement for the doctoral degree in the Horizons College. Generally speaking, as the student proceeds toward the doctorate, the student will progress toward the capacity to carry out all of six steps in the external program, completing with the case study publication.

The Horizons College will provide case studies for a fee to other institutions, as a means of gradually inducing other institutions to establish Horizons Colleges, and as a way of supporting the graduate program of the College.

1.10 Examples: Highly-Varied Previous Designs

What has been designed to this point using the concepts discussed here? Many diverse designs have been created by a diversity of individuals, and they have been reported in a variety of places. I will mention a few diverse designs, details of which have been reported briefly in one or more of my books, where the curious reader can find more information than I give here. My purpose here is to emphasize the ubiquitous nature of the science, its applications, and its client population. These range from the design for the individual to the design for the giant bureaucracy and the giant corporation. *Portable Stereo.*

By a university sophomore: a portable stereo system specifying (features, type, overall weight, driver material, frequency response, voice coil leads, ear pad material, headband pressure, cord type, and earpiece options). *Student Escort Service. By a*

small group of university sophomores: a latenight student escort service listing: (publicity, staff, hours of weekend service, hours of weeknight service, lagtime, number of vehicles, scheduling, reasons for use, riders, means of prioritization of users, area covered, method of transportation, operational funding, and overhead funding). National Legislation. By a

group of more than 300 defense program managers, with a little help from the U. S. Congress: "The Acquisition Streamlining Act of 1994". Corporate-Wide Product Information Management System. By a group of engineers at one of the worlds largest corporations: a corporate wide product information management system. *Revolutionary Disarmament*

and Demobilization Plan. By a group of warlords and warriors in Liberia: a plan for disarmament and demobilization. Foundation Food Distribution

Plan. By a foundation: a plan for providing food assistance to a nation whose government had undergone a coup, which cut off an established mode of providing help. *Tribal Self-Governance Plan.* By an

Indian tribe: a plan for enhancing selfgovernance.

1.11 Summary and Conclusions

Institutions of higher education quite properly undertake to develop among students the ability to question received doctrine. Little or no comparable attention is given to the ability to synthesize on the scale of complexity that is encountered today in public and private organizations. Hence the critical talent is unaccompanied by an ability to convert the recognized deficiencies into constructive change in organizations and societies.

Consequently, there is perpetual discontent, angst which grows and takes on many negative forms in organizations and societies, sometimes accompanied by large-scale disasters that wont quit.

In response to this situation, a creative appendage to institutions of higher education is proposed, called a Horizons College, which will specialize in growing a talent of design at a high level among selected students who have already developed a broad perspective on the world, and who have sufficient insight and motivation to be in a position to benefit from and to carry into organizations an education that will equip them to take leadership roles.

The Horizons College will be based intellectually in systems science, and it will draw upon much of the existing resources of higher education. It will be built upon a five-point plan of development, and will take advantage of a history of successful description and application of systems science that has been carried out external to higher education.

The challenge now is to import this fledgling concept into higher education, to grow it there, and to let it become an integral part of higher education, where it will offer a new and vital leadership capability to institutions at a time when the complexity of society and its institutions threatens to overwhelm us all.

But in the interim period, existing academic programs may find it appropriate to begin to recognize the cognition partition in their programs, where appropriate.

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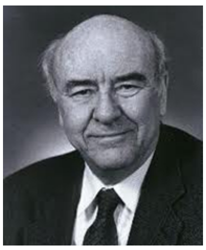

Professor John Warfield was a pioneer in system science. Professor Warfield received the Bachelor of Arts in 1948, Bachelor of Science in Electrical Engineering in 1948, and Master of Science in Electrical Engineering in 1949 from the University of Missouri, Columbia, Missouri. He received the Doctor of Philosophy degree from Purdue University, West Lafayette, Indiana in 1952. John Warfield is widely recognized as the father of systems science. He has been an educator, a research scientist in complex systems and organizational dynamics, and a leader in integrating an extensive body of research into an organized hierarchy of systems sciences. Dr. Warfield and his colleagues analyzed complexity and human cognition for over forty years and developed the founding relationships for the still-emerging systems science discipline that underpins significant portions of modern systems engineering. His rich body of work embodies analytical methods and frameworks, behavioral science and philosophies that formalize our understanding of complexity in our world. He holds IEEE Centennial Medal. In 2006 John N. Warfield was awarded the Joseph G. Wohl Award for Career Achievement and in 2007 he received INCOSE Pioneer Award and was also awarded the IEEE Third Millennium Medal.