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THIS ROOM HAS 20 CHAIRS: PREDICTION AND COMPLEXITY IN CONSIDERING DESIGN EXPERTISE AND DESIGN EDUCATION

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ABSTRACT

This paper addresses some of the more quixotic questions which arise when one asks about the intention of design expertise. Within the title, *This Room Has 20 Chairs* is a call to examine more deeply what seems obvious on the surface. A sign, *This Room Has 20 Chairs*, hangs in a university seminar room; but the room rarely contains 20 chairs. On any given day the number of chairs varies from 15-28, changing through the mysterious and often unpredictable processes of human intervention. The exact number of chairs at a particular time, on any particular day can only be ascertained by counting them, and that count will not be predictive of how many chairs will be there in the future. The sign *This Room Has 20 Chairs* is useless as a control mechanism in this world of subtle and unpredictable outcomes. It does however speak to Dr. Jampolsky's claim that, ". . . most of us are still seeking something else that we never find. We are still trying to control and predict and therefore we feel isolated, disconnected, separate, alone, fragmented. . ." [11]. This paper discusses what else designers can seek by examining the intersection of the intentions driving design decisions. It questions what purposes design expertise might serve, how it might contribute to a more livable future, and who might be its beneficiaries.

For the purpose of this paper design expertise will be defined as the ability to know how to move from – (R) a known and given point, or (S) - an ill-defined point, or (T) - a vague and confused point; to (Y) - an unknown future point or condition which can best be understood after its new existence is reflected upon within its context. This paper will discuss the role design expertise plays in facilitating a graceful, rewarding transition to an elegant point (Y). This design expertise is a *process expertise*, it is knowing *how* to do rather than doing. It is the skill of approaching rather than the skill of development that is the key to how other design proficiencies are implemented toward outcomes, predetermined or otherwise.

Exceptional elegant design, requires a number of capacities normally nurtured within industrial design education. These include developed intuition, understanding of experience, implementation of logic, employment of implicit and explicit knowledge, and refined sensory sensitivity. When skills development is directed by process expertise, design education can produce designers capable of sophisticated design development of products or systems. This paper suggests it is not only timely but also necessary for design process to include inter and intra-personal skills; the ability to recognize and understand varied expertise within different cultural and social contexts; and to understand and implement methods which enhance collaborative innovation.

Keywords: Collaboration, innovation, expertise, sustainability, process

1 DESIGN EXPERTISE

In the late 1960s and early 70s Jay Doblin, then head of design at the Institute of Design, Illinois Institute of Technology (IIT), Chicago, often introduced design expertise to new post graduate students by defining its domain in relation to two other areas - engineering and social science. Design he said, was about the interface between *people and things*, engineering – the interface between *things and things*, and social science – the interface between *people and people* [7]. Although simplified the definitions provided the context within which design issues could be identified and addressed; alluding to the some of the challenges of what Buckminster Fuller referred to as "Comprehensive Anticipatory Design Science". [3]

2 HUMAN CENTERED DESIGN

2.1 'Product Humanics'

One view of the history of design education is that it evolved from an apprentice/master pre-history into a university education with a strong focus on skills development, concept ideation, followed by development and refinement of form within the context of manufacturing constraints. As industrial design education evolved, along with ergonomics, marketing, product semantics, product semiotics, and the way meanings are constructed, was integrated into most programs. When Art Pulos developed the industrial design program at Syracuse University, he coined the term '*product humanics*' for one of the key areas of study in that 5 year program – "analysing and defining human needs and developing . . . products that serve them" [16].

2.2 Interfaces and Interactions

At the Institute of Design, IIT, human-centered design has evolved from traditional design, social sciences, engineering and business. The program further developed Doblin's initial definition of design domain to include people's interactions with systems, organizations, and messages as well as products. At IIT design expertise is taught using a framework which addresses the physical, cognitive, social and cultural factors of these interfaces and interactions. *Ethnographic observation* and the use of video recording for documenting and studying the behavioral interface, and disposable camera studies which engage the user in selecting and recording information cogent to design issue are some techniques currently employed within progressive educational industrial design programs. Often ethnographic research techniques are used in conjunction with the development of prototypes which are created to address the identified design issues then observed in use and analyzed toward evolving a more elegant and comprehensive design solution. These prototypes themselves are an emerging area of expertise to be taught to the developing designer and provide opportunity for collaborative innovation with a range of experts.

2.3 'New Human Factors'

As the physical, cognitive and social human factor knowledge base and associated expertise expands unique areas emerge such as what IIT refers to as 'New Human Factors' including "methods to understand the broad terrain of human needs in a methodical way – needs people may not even know they have . . . Employing the principles of human factors, in combination with ethnographic observation methods, can help product-development teams create value-rich products that not only satisfy but also delight their users." [10]

The reference to "teams" is pivotal. Although individuals continue to emerge as unique designer/artist/architect icons such as Marc Newson, Philip Stark or Frank Ghery; team design has become a proven standard in contemporary design practice. In a paper for *Creativity and Cognition,* Nigel Cross draws a parallel to engineering design. Individuals like "Gordon Murray" and "Victor Scheinman" are each known for authoring a number of specific innovative breakthroughs, but even individuals must increasingly work collaboratively to achieve comprehensive excellence for any product, system, or idea they may initiate [5]. Complexity and the rapid advancement of knowledge in virtually all fields points to the need to develop and teach better team approaches and methods in order for problems to be identified and resolved elegantly within their context.

2.4 Consultative and Collaborative Design Process

Facilitating team design in itself requires specific expertise. Consultative process encouraging maximum opportunity for innovation without suppressing individual creativity is a challenging and necessary body of knowledge for designers to explore and develop. As with ethnography substantial research and study has already been done in this area in the social sciences, business and management. Looking at the ways this knowledge can be drawn upon by the design community requires further innovative processes to be developed. For instance it is possible to adapt and apply the work of both Dr. Richard Thomas, professor of American History and Urban Affairs and John Kolstoe, a specialist in consultative processes. The guidelines which they have identified for managing collaborative and consultative practices in diverse groups are likely to enhance the collaborative design process, by balancing power differentials for example. [20, 12]

2.5 'Structured Planning'

Charles Owen has developed 'Structured planning' over the last thirty years. Sparked by Chris Alexander's work as described in *Notes on the Synthesis of Form* [1], "structured planning is a process for finding, structuring, using and communicating the information necessary for design and planning activities. It is a front-end process for developing concepts." [15]. A process that has produced award winning results, this and other methodologies that deal effectively with complex systems should be further nurtured and developed. They serve as quality platforms for consultative design process which in turn supports team design at a more comprehensive level than traditional approaches.

2.6 'Comprehensive Form/Context Synthesis'

The authors' have explored the development of diagramming as a method of design development used in conjunction with Owen's proprietary programs RELATN and VTCON. The process is called Comprehensive Form/Context Synthesis. The diagrams are a specialized language esoteric to each design team. Diagrammatic innovation in this instance is developed in a way similar to a group of musicians with varied musical backgrounds, knowledge and experiences creating a new piece of extemporaneous jazz. Examples of diagrams shown in Figures 1, 2 and 3 indicate how they express a unique character reflective of each team.

"One of the key issues in a multi-national, multi-cultural arena is communication, which needs to consider the reality of multiple meanings and values [within] a diverse group... The diagrams, (visual metaphors) represent a layered understanding of the" contextual form needed to best resolve the particular problem space. Diagramming "is a fluid

process that requires the group to [create and] refine the aesthetic" as a means of progressing toward a best fit solution. Developing a number of diagrams at a simple level then resolving and integrating them toward a comprehensive design solution provides opportunity "for comprehensive understanding and communication to occur." [4] These examples were generated by 4th year student teams in Advanced Design Methodology and team personality is clear in the diagrams below.

Each diagram represents the team's highest level form/context solution for the Elizabeth Special School's outdoor learning system. All teams addressed the same existing conditions at the school which serves the needs of students with a wide range of physical and mental disabilities. Through the diagrammatic methodology each team identifed a significant number of 'form' solutions to needs within the existing environment. The solutions are currently being implemented as funding permits.

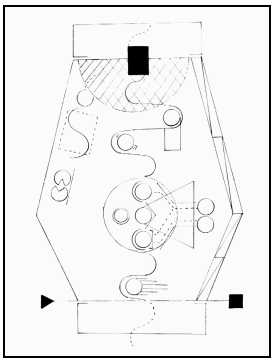

Figure 1
Student
Team-A

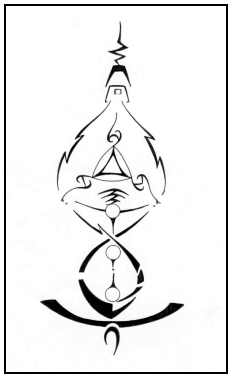

Figure 2
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Team-B

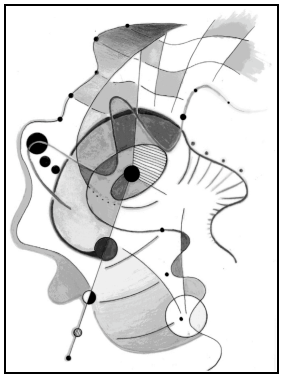

Figure 3
Student
Team-C

3 INTENTION OF, AND NEED FOR DESIGN EXPERTISE

Currently, the establishment of design objectives are determined by those who define the problem, who write the brief, who develop the solution, and who pay for the outcomes regardless of who is targeted to benefit or in what way, or who may be affected by the outcomes. In a discussion of public policy, Carol Bacchi challenges the way problems are currently identified and the assumption that a *correct* solution is possible. Bacchi argues that solutions are driven by the question "What's the problem?" [2]. Based on the problem statement the solution may or may not address needs of varied segments of the population. Solutions are not to a defined and clear problem, but rather only a response to a particular point of view reflecting the bias of the participants who develop the problem statement. Similarly how a design problem is defined can also predetermine whose needs or wants the final design solution addresses. The needs of groups who are not party to the creation of the problem statement may be excluded.

Donald Norman in an interview for New Scientist Magazine, expresses his dismay at the lack of collaboration between several professions directly involved in product design; designers with expertise in making "attractive things"; computer scientists and psychologists who understand usability but "don't know how to build anything" and who don't understand business; and ethnographers who understand people's needs but not how to translate those into products. Norman goes on to say "So all this has to come together, otherwise no decent products will result." [9].

4 DESIGN INTENT

4.1 Comprehensive Design Intent

R. Buckminster Fuller suggested there is a relationship between how effective a designer is, and the intention of his work. "Observation of my life to date shows that the larger the number for whom I work, the more positively effective I become. Thus, it is obvious that if I work always and only for all humanity, I will be optimally effective" [3].

Comprehensive design expertise can be focused toward diverse outcomes. The results of any approach which recognizes the complexity of problems and employs a diversity of expertise in design methodology and process; engineering and social sciences` will generate, if well managed, more *elegant* results. Fuller suggested that humanity is connected in such a way that no sensible alternative exists but for humanity to cooperate and evolve through attention to global sustainability. In his discussion of *World Game*, described by him as the antithesis of *World War Gaming*, Fuller pinpointed the need to find ways to effectively employ all of the world's resources, the accumulated knowledge of humankind, and the existing technological tooling of 'Spaceship Earth' toward the successful design of a sustainable global society. *"The success of all humanity"* he claims, *"can be accomplished only by a terrestrially comprehensive, technologically competent, design revolution. This revolution must develop artifacts whose energy-use efficiency not only occasions the artifacts' spontaneous adoption by humanity, but therewith also occasions the inadvertent, un-regretted abandonment and permanent obsolescence of socially and economically undesirable viewpoints, customs, and practices."* [8].

In a statement which speaks to creation of a global development strategy that supports a sustainable global society and ecology, the Office of Public Information of the Bahá'í International Community, identified *"the protagonists to whom the challenge addresses itself," as "all of the inhabitants of the planet: the generality of humankind, members of governing institutions at all levels, persons serving in agencies of international coordination, scientists and social thinkers, all those endowed with artistic talents or with access to the media of communication, and leaders of nongovernmental organizations."* [14]. Fuller identified the need for a design revolution. Not a revolt against history but toward fuller participation in global decision-making framed by humane and sustainable goals.

4.2 Diagramming Design Intent

In 1968 Charles Eames diagrammed the overlap of three special interests groups, the design office, the client, and the society. In this area of overlap the designer can work with conviction. Relationships between professions in the overlap develop as each influences the others while seeking their own interests. [13] Seen from Eames' area of shared interests, Doblin's *engineering, social science, industrial design* domains are where people and things interface, and where comprehensive design decision-making involving all three domains takes place; outcomes changing as the intent of expertise changes.

5 INTENT OF EXPERTISE

Figures 0-4 and 0-5 discuss the effects of changing intentions of expertise in all domains. Each uses the interface domain categories identified by Doblin, (A) - *things to*

things, (B) - *people to things,* and (C) - *people to people.* In figure 0-4 the three are independent spaces as described by Norman in *NewScientist*. Each independently choosing its agenda. Human centered design (B) borrows from both engineering and social science to make the interface between *things and people*. In this model (B) hardly influences (A) or (C) other than through shared interests as Eames described. Synergy toward optimum outcomes using collaborative consultation is generally missing or compromised.

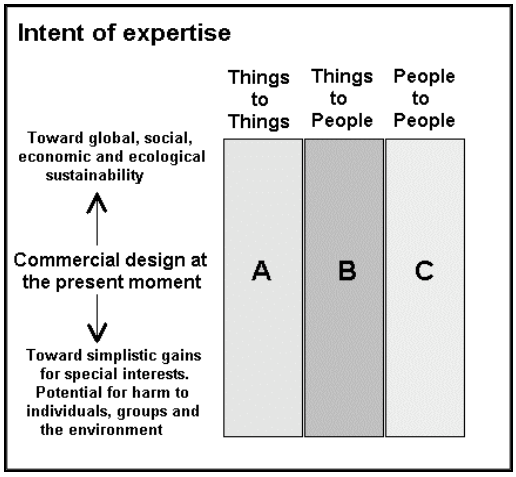

Figure 4 Diagram of the current paradigm, the relationship of human centered design, engineering and social science with intent of expertise as a flexibility factor within each domain separately

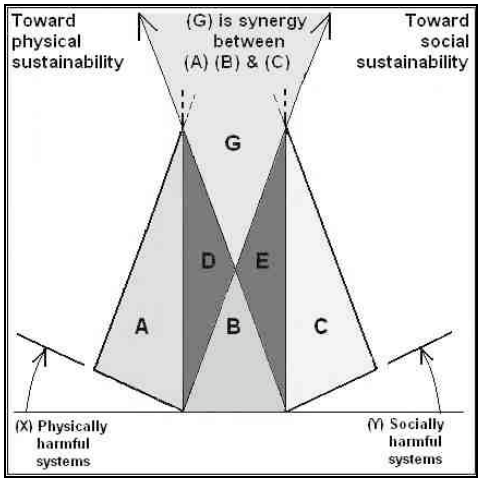

Figure 5 Diagram of collaborative synergy as intent of expertise is global sustainability. (A) (B) and (C) collaborate in the design process. (X) and (Z) push (A) (B) and (C) toward sustainable goals.

The current paradigm as exampled in figure 4 tends to be commercially focused. (A) directs manufacturing and engineering to match client goals, (C) tries to support government and/or business management objectives, and (B) attempts to integrate aesthetics, utility, and social profiles to match market demands. At its lowest level (A) focuses on material efficiency - either in manufacturing time, use of materials, or function without necessarily considering the effects on the social or physical environments. At the most globally destructive level this might be development of weaponry, land mines, creation of efficient but scarring processes such as strip-mining, or dehumanizing manufacturing machinery and processes endangering humans and/or the ecology. At the higher level (A) might consider goals including sustainability that result in use of alternative energy, sound environmental materials, low impact manufacturing methods and machinery reflecting appropriate and specific socio-economic conditions, and outcomes which look at long range costs.

Figure 4 suggests that (C) has similar choices. It can support oppressive and inequitable social systems limiting socio-economic opportunities, or even support unfair imprisonment, torture, and other forms of mental, emotional and physical violence. But (C) can also choose to foster opportunities for justice, encourage all citizens to

contribute to society as well as make ethical choices. It can support a system of education based on opportunity rather than the lack of it. It can recognize and support the value and growth of the human spirit. Nobel Peace Prize winner, the Dalai Lama suggests human spirit exists in all people and societies. "The desire for joy and pleasure and the desire to get rid of pain, suffering and fear, the appreciation of love and compassion, these are all aspects of the basic human spirit. Whether we believe in this religion or that religion, or even in no religion at all, is irrelevant. As long as one is a human being, that feeling is there; the human spirit is there." [6].

(B) also influences or directs where to work on the *Intent of expertise* scale. Design decisions can be determined by expediency, working less for the elegance of design solutions and more for things such as planned obsolescence. They may choose to ignore usability, or ecological impact, or even choose to design intending injury, death or destruction. In this scenario, like (A) and (C) designers do have opportunity to approach comprehensive design solutions that promote human well being and include sustainability in their goals. What is of interest in figure 4 is that regardless of intention, collaboration between (A), (B) and (C) may be minimal or even competitive.

6 CONCLUSION: 'COMPREHENSIVE ATICIPATORY DESIGN SCIENCE'

It is evident and obvious that the intention of expertise in design, engineering and social science affects the outcomes of the actions in each domain. When design mediates collaboration among participants from material and social realms toward globally sustainable goals, a graceful, elegant, peaceful productive future for humanity can be the result. As figure 5 describes, when (X) – potential ecological disaster and (Z) – potential social disaster press (A), (B) and (C) to 'lift their game' toward sustainability a (D) and (E) can be essential. (D) is a close collaboration between (B) and (A) on issues of material concern to both. (E) is a close collaboration between (B) and (C) on issues of social concern to both. As expertise in all three areas continue to focus on global sustainability a fluid collaboration is likely to occur. This is fostered when design expertise implements cooperative, collaborative and synergistic processes. When (B) benefits from collaborative management expertise, it becomes the facilitator of the process. Then all three (A), (B) and (C) enter the higher realm of (G) – a collaboration between the three domains, fostered by an inclusive and consensus building process likely to result in the innovation necessary to address the complex problems of ecological and social sustainability. That process is likely to be more successful if it benefits from the diverse understanding, knowledge, and participation of a multiplicity of social, national, cultural, and expert groups using synergistic methods for consensus based collaboration, avoiding attempts to predict and control outcomes to align with inequitable advantages for specific vested interest groups. Then all domains can together foster happiness, health and wellbeing for the world's population. This is a huge task and *"The effort of will required for such a task cannot be summoned up merely by appeals for action against the countless ills afflicting society. It must be galvanized by a vision of human prosperity in the fullest sense of the term – an awakening to the possibilities of the spiritual and material well-being now brought within grasp. Its beneficiaries must be all of the planet's inhabitants, without distinction, without the imposition of conditions unrelated to the fundamental goals of such a reorganization of human affairs."* [14].

REFERENCES:

[1] Alexander, C., *Notes on the Synthesis of Form*. Harvard University Press,

Cambridge, Mass., 1971
[2] Bacchi, C. L., *Women, Policy and Politics - The Construction of Policy Problems.* SAGE Publication Ltd., London, 1999
[3] BFI, Buckminster Fuller Institute, www.bfi.org 2001
[4] Coker, J., Teaching Advanced Methodologies within the Undergraduate Program: a case study. In: Proceedings of International Congress of Societies of Industrial Design Educational Seminar, Seongnam, Korea, 2001, pp 201-9
[5] Cross, N., Creative Cognition in Design: Processes of Exceptional Designers. In Hewett, T. and Kavanagh, T. (eds.), *Creativity and Cognition.* ACM Press, New York, 2002
[6] Dalai-Lama, Inaugural Speech. In: Wijers, L. (ed.), *Art Meets Science and Spirituality in a Changing Economy: From Competition to Compassion.* Academy, London, 1996
[7] Doblin, J., Introductory Lecture Master's Program Illinois Institute of Technology. In: Coker, R. *Student Notes*, 1967
[8] Fuller, R. B., *Critical Path.* St. Martin's Press, New York, 1981
[9] Grossman, W. M., Designed for life. *NewScientist,* 176, 2002 pp 47-49
[10] Institute-of-Design, *ID Methods*, www.id.iit.edu/ideas/methods.html, 2002
[11] Jampolsky, G. G., *Love is Letting Go of Fear.* Bantam Books, Berkeley, 1981
[12] Kolstoe, J., *Developing Genius - Getting the Most Out of Group Decision-making.* George Ronald, Oxford, 1995
[13] Neuhart, J., Neuhart, M. and Eames, R., *Eames Design, The Work of the Office of Charles and Ray Eames.* Harry N. Abrams, Inc., New York, 1989
[14] Bahá'í International Community, *The Prosperity of Humankind.* Office of Public Information, Haifa, Israel, 1995
[15] Owen, C. L., *Structured Planning.* Advanced Planning for Business, Institutions and Government, Institute of Design, Illinois Institute of Technology, Chicago 2001
[16] Syracuse-University *Undergraduate Catalogue.* www.syr.edu/publications/undergradcat/VPA 2003.
[17] Team A – T. Clifford, A. Delaney, N. Lockwood, T. Oliphant, D. Roberts
[18] Team B - J. Carter, J. Haifawi, M. Kamaludeen, M. Merlino, K. Rutkiewicz
[19] Team C – P. Christensen, L. Gorgula, J. Grandberg, W. Puz, R. Wold
[20] Thomas, R. W., *Racial Unity: an Imperative for Social Progress.* Association for Baha'i Studies, Ottawa, 1993

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