TYING BOTH ENDS: A CASE STUDY OF SUCCESSFUL COMPREHENSIVE DESIGN COLLABORATION

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ABSTRACT
This paper is an overview of one student project employing *Comprehensive form-context synthesis*; a collaborative design methodology used to successfully address '*wicked*' problems.
The *Advanced design methodology* class at the University of South Australia was asked to collaborate with the Elizabeth Special School (ESS), to enhance the quality of their outside learning/play area for their students, who have a range of physical and mental limitations and disabilities. The class enthusiastically engaged the methodological approach which ultimately includes diagramming from a force tendency statement hierarchy. Initially, they conducted a research phase which included site visits and interviews with expert staff and administrators at the school. The class worked in groups to employ the comprehensive design process collaboratively generating form solutions intended to reflect a clear fit. Students then reviewed their group work and individually develop specific design concepts using traditional design processes in their final year studio.
This paper follows a specific project, chosen by the administrators and staff at ESS. The process was truly collaborative. It involved various evaluation stages during design and development process, requiring engineering input and material and fabrication alternatives, considering safety issues, cost, and of course planning approval. Funding sources were identified and budgets were stringent yet realistic so as not to compromise the quality of the design concept.
It is an example of a design process that leads to a quality comprehensive design concepts actualized without concession, through collaborative nurturing, and adherence to the designers' vision.

Keywords: Comprehensive form-context synthesis, collaboration, design methodology

1 PICKING UP THE STRING

In 2002 the *Elizabeth Special School* (*ESS*) principal was seeking assistance to develop the school's outdoor space and facilities to provide enhanced learning for the school's student population of children with multiple physical and mental limitations and disabilities. Concurrently final year industrial design students were entering the *Advanced design methodology* (*ADM*) course; intended to build their understanding of complex systems design problems and provide them an opportunity to work on such a problem. The authors, Jan Coker and Richard Coker, lecturers in *ADM* and final year

studio respectively, saw the *ESS* problem as ideal because it contained the complexity needed, to challenge the creation a frictionless fit between design form and its context.
Design problems can in general be understood as either, *well-defined* or *ill-defined*. Within the *ill-defined* category is a further subclass; identified as *wicked* problems. Peter Rowe summarizes *well-defined*, *ill-defined*, and *wicked* problems; explaining that *wicked* problems are those without a 'possibility of becoming fully defined . . . [and without a] basis for termination of problem-solving activity – no *stopping rule*' [1]. They are also problems with the potential for multiple and diverse solutions. Not only do they defy definition, they are in a constant state of flux, and there is a tendency to erroneously define them as only mechanistic systems. A purely mechanistic model of a *wicked* problem can ignore important organic, contextual, and social aspects, by mistaking what Alastair Mant calls a 'bike-like' system for what is really a 'frog-like' system. 'The essential difference between the frog and the bicycle, viewed as systems, lies in the relationship of the parts to the whole. You can take a bicycle completely to pieces . . . and reassemble [it, and]. . . the whole thing will work perfectly. . . [however in a frog] once you remove a single part, the entire system is affected instantaneously and unpredictably . . . if you go on removing bits the frog will make a series of subtle, but still unpredictable, adjustments in order to survive . . . until . . . quite unpredictably, the whole system will tip over into collapse. Most big . . . systems contain bikish and frogish bits – that is, bikish parts which can be hived off and reattached in a new way without harming the overall system, and frogish parts which really are part of the core process' [2]. An accurate description of a system's bikish and frogish bits and overall bike-frog nature is necessary to define the constraints correctly and lead to a successful design solution. Assuming a system is a collection of parts and ignoring the synergistic whole, results in incomplete system definitions and poor solutions.
A *wicked* problem like the one presented by the Elizabeth Special School has multiple stakeholders and intertwining interactions among a diversity of people and systems. In *ADM* students used *Comprehensive Form-Context Synthesis* (*CF-CS*), to consider a fuller range of views of the problem. In teams of 4-6, the students developed form solutions through a process of critical analysis, metaphorical diagramming, creative innovation and consensus decision-making to best fit the context.

1.1 Comprehensive Form-Context Synthesis (*CF-CS*)

CF/CS is a collaborative design methodology composed of two components: (1) interpersonal processes to generate effective and equitable collaborations; and (2) design methods for addressing 'wicked' problems. The process as a whole provides:

- A structured heuristic method which can be easily understood and effectively learned and engaged within a relatively short time.
- A way for solutions to remain open as long as possible in order to identify the best fit between form and context; rather than accepting quickly identified, forced, prescriptive solutions that have not adequately considered multiple, alternative possibilities.
- Opportunities for critical reflection and analysis of the problem, and freedom for creative innovation, while maintaining the cohesiveness of the collaborative group.
- A diagrammatic pattern language, or 'design' language in which participants are equally competent to solve the problem collaboratively.
- A platform for consensus building, collaborative designing, and decision-making among diverse people that can benefit from alternative understandings and cognitive modalities inherent in multi-cultural, multi-disciplinary groups.

1.1.1 Interpersonal processes and group procedures for collaborations

CF-CS incorporates a structure for group interactions which enhances the diversity of views expressed and diminishes conflict within the working team. Appropriate elements of processes for conflict resolution were combined with the consensus decision-making method - *Consultation*, as used within Bahá'í communities [3, 4]. These structures and processes led the working teams to direct their activities toward the goal of '*realistic mutually beneficial* ***design*** *outcomes*' for all parties. *CF-CS* includes communication techniques, synergy building structures, a collaborative ethic and consensus decision-making process. These govern conduct and processes to quickly create a spirit focused on harmoniously serving the needs of the project.

1.1.2 A design methodology to address 'wicked' problems

CF-CS is a structured collaborative methodology to be used by teams. It employs methods that seek to define a problem comprehensively within its context and innovate solutions having appropriate functional, aesthetic, and socially significant attributes.

CF-CS evolved from Christopher Alexander's methodology addressing the first four provisions above, and described in his classic work, *Notes on the Synthesis of Form*. He identified 'a legitimate relation between a system of logic and the needs and forces' in a complex design problem; and saw no conflict between the demands of logic and 'the designer's greatest gift, his intuitive ability to organize physical form.' [5, 6]. When the internal structure of the problem is uncovered, Alexander insists two conditions are needed to select an appropriate solution. It must be possible to:

- Generate a wide range of possible alternative solutions symbolically.
- Express all the criteria for solutions in terms of the same symbolism.

CF-CS achieves both of these by employing diagramming. The importance of the use of diagramming cannot be overstated. It is helpful to understand the way in which it functions in complex design problems. The diagrams are abstract, metaphorical patterns of physical relationships expressing interacting and conflicting forces. Each diagram of subsystem relationships is created independently of the others. By fusing these diagrams, the form-context design of the whole system is revealed. *CF-CS* uses Charles Owen's proprietary 'clustering' program to identify the semi-lattice hierarchy of the sets of inter-related force tendency statements [7]. The resultant sets of statements are diagrammatically developed and merged to find the form-context system diagram and model. Below is an example of a semi-lattice and resulting diagrammatic evolution from a team project of the author's; a mass transit system.

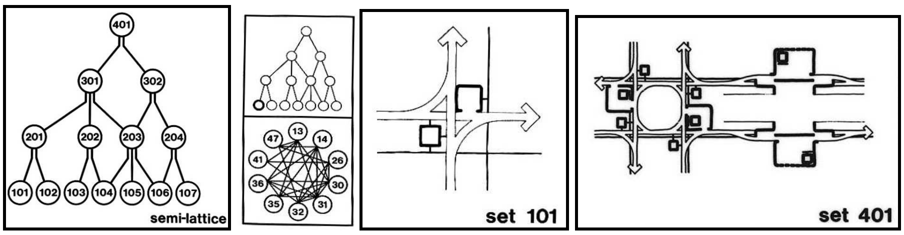

Figure 1 Example of evolution of diagramming from lowest level set 101, composed of statements indicated, to the final diagram of the whole system, reflecting overall issues occurring within both terminal and individual cells of activity operating within the system.

1.1.3 The student project

Students developed the force tendency statements, and created a matrix identifying interactive pairs. This data, run through an algorithm, produced a hierarchy of interrelated statements. The students then developed a diagrammatic *metaphorical* comprehensive solution to the complete problem. Below are two examples.

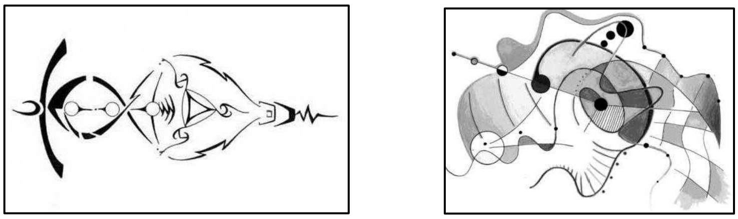

Figure 2 Teams created diagrams esoteric to their own members but identifying similar issues

The students pursued the following design path.

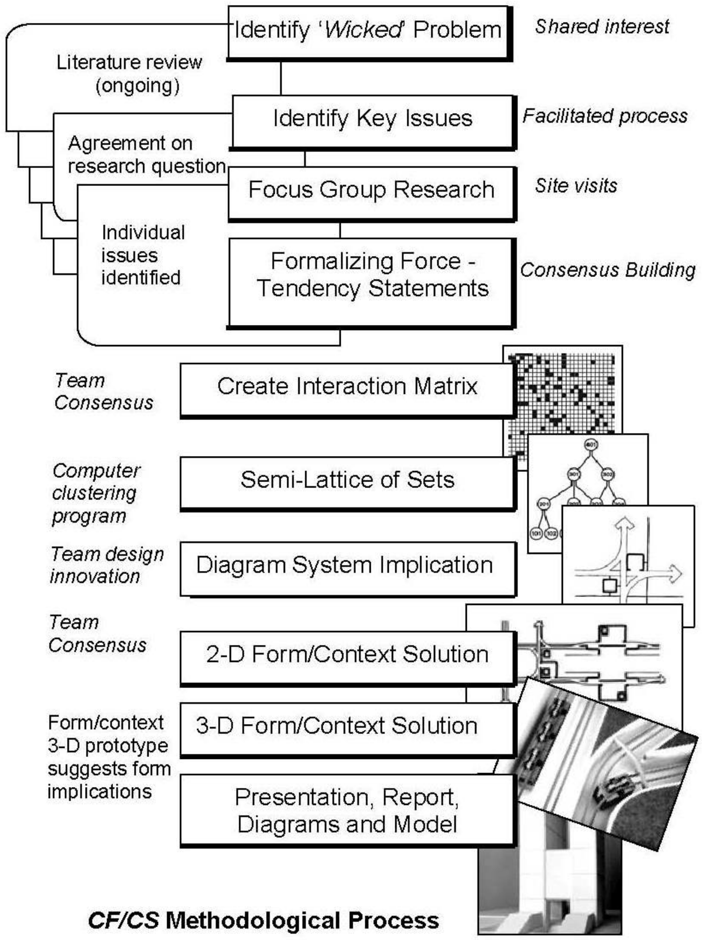

Figure 3 Comprehensive Form - Context Synthesis design methodology

2 CLOSING THE DESIGN LOOP

The students having completed the collaborative and conceptual design stage in *ADM*, were asked to reflect on their diagrams and models in their final year studio. They engaged a project of one-week's duration to present a one-point perspective sketch of an aspect or environmental object clearly indicated by their design solution diagram. This was the personal process of design drawing commonly used in the profession. The creative, process of design drawing facilitates speculative design development. The drawn images develop and take on identities and lives of their own. One evaluates constantly as a range of possibilities emerge and refinement occurs. We compare drawn images with those in our mind's eye seeking deeper meaning and the eloquence of inspired harmony within the context of the design objective. Drawing becomes an intuitive tool facilitating visual thinking during the creative process.

Shoshanna Roberts' perspective drawing included a unique apparatus consisting of large, weighted, soft surfaced fruit forms, which hung from a circular structure well above adult head level, sheltered by 3 large mushroom shapes. It specifically addressed some of the needs of autistic children who found comfort in having pressure on their bodies. Roberts chose to develop this into her graduation project. The concept presented in her perspective sketches had the enthusiastic support of *ESS* school principal Clive Budden, and Leanne Sanders, Specialist Teacher. Roberts created a full scale mock-up of fruit elements and, under the supervision of ESS staff, encouraged the children to try it. This "test on application" met with overwhelming success. Shoshanna then concentrated on identifying appropriate materials and more detailed configurations, and fabrication approaches for the fruit elements and support structure, as well as the integrated mushroom shape shelter. Her final submission included a detailed 1:5 scale model, and a full scale model of a fruit element, and a report of her research and design development.

Figure 4 Graduation exhibition (detail) – Shoshanna Roberts

3 TYING BOTH ENDS OF THE PROJECT

This work was subsequently turned over to the *ESS* along with the right to use the intellectual property to develop the equipment and also access the other project outcomes of a comprehensive design for the entire outside learning area. The authors supported the school through design consultation, and developed sketches for planning approval. The school chased money for the project. Crispin Joos, the project leader working with young people at risk, under the Playford City Council's Target project, prepared the site and consulted with Koukourou Engineering to develop the final structural details. The original design intent was maintained during this stage by the team of collaborators who avoided compromise in quality and configuration of the original designer's vision as it became a reality.

This final stage of the project, encountered and dealt with a number of tests and difficulties, too numerous to detail. It is a tribute to the Principal who postponed his retirement because of his commitment to the overall project, that it was seen to completion, Crucial to its actualisation was the collaborative processes throughout the project. The overall design for the entire outdoor learning area, also included elements not shown. This paper describes one detail consisting of *isolets* such as the fruit and mushroom elements, which can be viewed as a single *set* of a number of *sets*. Together they make up the whole design *pattern* of the project, completed and officially opened in a community event, on 11 April 2007. The project has been recognized as a great success by all the stakeholders.

Figure 5. The project, with Leanne Sanders and Crispin Joos (left), with the author (right)

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