Designing for Children
- With focus on 'Play + Learn'

Designing a 'Play + Learn' Environment at the Elizabeth Special School, for children with multiple disabilities: *collaboration with design students, community, and government.*

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Abstract: This paper describes a university project to develop the outdoor space of the *Elizabeth Special School* to provide enhanced learning opportunities for the school's student population, consisting mostly of children aged 4 – 12, with multiple physical and mental limitations and disabilities. The school director approached the university seeking help and ultimately the final year industrial design students accepted the project. Due to the project's complexity, students enrolled in Advance Design Methodology course were initially concerned that they would be unable to significantly assist the children at the school. After multiple site visits, interviews with specialist staff at the school, and interaction with the children, The university students came to embrace the project enthusiastically. This paper follows the design process and collaboration with the school and other stakeholders. The development process involved various stages of refinement to achieve an elegant solution. Engineering, detailing, cost estimating, material fabrication, prototyping and testing, identification of safety issues and negotiation of government planning approval were successfully negotiated without compromising the initial conceptual design intent.

Key words: Comprehensive form – context synthesis, wicked problems, mutuality, and heuristic process.

1. Introduction

> 'There is always an easy solution to every human problem – neat, plausible, and *wrong*.'(Mencken 1949 p443)

This paper is about finding elegant, functional 'right' solutions and follows the story of matching the needs of *special* children with *multiple* and *diverse disabilities* with the needs of industrial design students to learn how to address very complex design problems. The design methodology the students engaged, and its use within the educational environment, was intended to facilitate the opening of students' minds to ways they might identify and address these kinds of problems. Students were invited to seek creative solutions through a combination of critical and imaginal processes, working in partnership with people and organisations outside the university, in this case the Elizabeth Special School staff and children, the government, and the community.

The Elizabeth Special School is a primary school for children with many different kinds of impairments both physical and mental which preclude them from full participation in a standard primary school environment. These impairments can range from partial to complete physical immobilization, and from moderate to severe mental disablement. The usual outdoor equipment found in traditional schools and playgrounds is often inappropriate or extremely frustrating to use for children in this group. Professional designers of public spaces have made little more than a superficial attempt to meet the needs of the disabled, or even to identify or analyse their physical and mental capabilities when looking at outdoors or playground equipment. Our students' project was to engage this kind of research toward achieving a practical outcome. By approaching the design using this methodological approach, an unexpected unique solution was achieved reflecting innovative elegance. This solution also met the needs of the majority of able-bodied children as characteristically happens when inclusive design is successfully accomplished. It shows that by incorporating universal design goals into a project and designing for the 'margins' of human user groups, the solutions will also embrace the needs of the healthy majority more effectively as well.

2. The Advanced Design Methodology Class

The Advanced Design Methodology class was intended to provide an experiential learning environment for final year industrial design students. The goal was to provide an environment for these students which would teach them how to work collaboratively with diverse people and professions on complex real world problems or *wicked* problems, as they are often termed. *Wicked* problems as defined, have no clear or discreet criteria for understanding what is needed. First mentioned in a published work by Churchman (1967 pp

141-2) who attributed the concept to Rittel, who together with Webber (1973 pp 155-69) described the attributes of *wicked* problems in a paper on complexity. More recently Peter Rowe summarized these attributes in his analysis of design approaches explaining that *wicked* problems are problems without a 'possibility of becoming fully defined [and without a] basis for termination of problem-solving activity – *no stopping rule.*' They are also problems with the possibility of multiple and diverse solutions (Rowe 1994, p.41).

Due to the project's complexity and the students' unfamiliarity with disabled children and their needs, the design students were initially apprehensive about the project. The class made a visit to the school where they had an opportunity to experience the environment first hand, before going forward with the project. They were able to get to know the children and see the diversity of their capacities and incapacities. Students formed design teams then followed the *Comprehensive form - context synthesis* methodology, illustrated below. This led to a set of system solution diagrams that highlighted the relationships of significant issues providing a context for form solutions to evolve. A number of diverse, innovative concepts emerged enabling the students to describe clear and specific design briefs. The resulting design concepts were consistently insightful and innovative. The collaborative group reviewed the designs and chose one to be developed and ultimately built on site. The student teams work collaboratively toward consensus decisions, using full and frank discussions in order to explore the advantages of synergistic understanding (fig. 1-3). The decision-making was collaborative in all stages of development until after the final 3-D form model after which discreet criteria for applied design became apparent.

Figure 1 – Students in Advanced Design Methodology translating statements into diagrams.

Figure 2 – The same students working on refining diagrams to address frictions and fits.

Figure 3 Students in Advanced Design Methodology working through the *Comprehensive form - context synthesis* process, on the Elizabeth Special School, this team is in the 7th stage of the process merging the diagrams up the semi-lattice hierarchy.

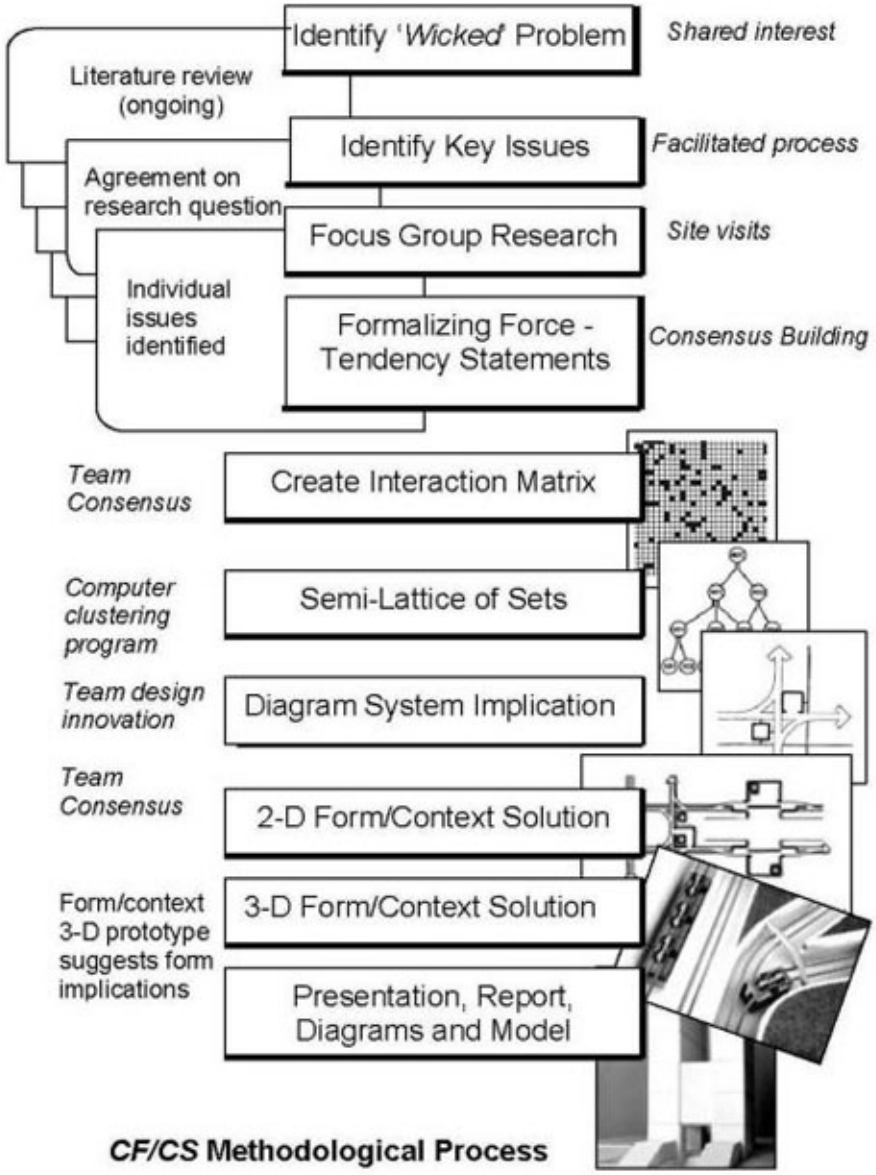

Figure 4 Comprehensive Form - Context Synthesis, the design methodology used by students to engage the *wicked* problem of the Elizabeth Special School outside play area.

2.1 Comprehensive form – context Synthesis

Comprehensive form – context synthesis is a front-end heuristic design methodology developed by the authors to address complex systems design problems. The problems are addressed comprehensively within collaborative teams. Holistic or form solutions to complex design problems are sought within their identified social and physical context. Comprehensive form – context synthesis has two components; design methods for addressing *wicked* problems and interpersonal processes to support effective and equitable collaborations. Together they provide a platform to define a problem comprehensively by

clarifying its context and acts to facilitate the collaborative group to generate a number of innovative solutions all potentially having appropriate functional, aesthetic and socially significant attributes.

The design methodology provides:

- A structured heuristic approach that can be easily understood learned and effectively applied within a short time.
- A way to manage the complex components of *wicked* problems so that potential frictions and fits are revealed; new approaches and solutions remain open as long as possible; and preconceived design solutions that do not adequately consider the multiple alternative possibilities are avoided.
- A diagrammatic language that enable participants to develop fluency and communication competency in order to address the problem collaboratively.
- Opportunities to critically analyse the problem and provide freedom for insightful creative innovation to occur.
- A structured process that maintains the cohesiveness of the collaborative group while providing a platform for fully expressed, frank and honest examination of issues.
- A platform for consensus building, collaborative designing, and decision-making among diverse people that benefits from multiple understandings available in multi-cultural, multi-disciplinary groups.

As you can see from the diagram of the methodology (fig. 4) the first 3 stages of the process are devoted to agreement on the problem to be addresses and research and identification of individual issues, which are formalized in the 4th stage into statements of forces and tendencies. A decision about the relative importance of each statement is made through a consensus process until everyone is convinced each statement is needed. In stages 5 and 6, clustering software is used to produce a mathematical map of the order of the statements condensation into a semi-lattice structure of sets of statements grouped in sets of 3-9 reflecting the highest intensity of interaction of the statements within each set. In stages 7 and 8 a diagrammatic language is created by the team first by translating the statement into the visual language and then resolving the frictions and fits visually. Each diagram is then merged as indicated by the semi-lattice up the hierarchy of clustered sets of statements until a single diagram reveals a 2-D form solution. This 2-D form solution suggests a 3-D form/context solution.

Comprehensive form – context synthesis evolved from and was inspired by Christopher Alexander's methodology described in his seminal work, *Notes on the Synthesis of Form* (1964, pp. 11), in which he suggested both the application of 'logic' and the 'designer's greatest gift, his intuitive ability to organize physical form.' Alexander pointed out that 'physical clarity' cannot be 'achieved in a form until there is first some programmatic

clarity in the designer's mind and actions.' Therefore the designer needs to 'trace his design problem to its earliest functional origins' and find the 'logical' frictions and fits between 'form' and 'context,' then he can seek to find forms which are well adapted to the given context. 'The rightness of the form depends . . . on the degree to which it fits the rest of the ensemble' (Alexander 1971, pp. 3-17).

2.2 The Elizabeth Special School Project in Summary

After the design students reflected on what they learned during a visit to the Elizabeth Special School, they all came to embrace the project enthusiastically. Moving forward heir research included needs assessment gained through multiple site visits, interviews with specialist staff at the school, and interactions with the children as well as their independent research. The project demonstrated that the front-end design process that was used, Comprehensive form – context synthesis resulted in at least one quality comprehensive design concept that became a reality. It indicated that a design concept could be actualized without compromise through collaborative nurturing, and maintaining the original vision. The success of these projects also indicated the depth of the students' understanding of *wicked* problems and their successful engagement of design approaches to them. Students' experiential learning was self-validating.

The collaboration developed further than previous projects in this course and involved various stages during the design and development requiring engineering input, alternative material fabrication consideration in relation to safety issues, cost, and negotiating government planning approval. Funding sources had to be identified and budgets were stringent yet realistic, and did not compromise the quality of the design concept.

2.3 Some Project Detail

There were six teams involved in the project each working independently. One aspect of this was the diversity of the style of diagramming, below (fig 5). After completing their diagrammatic exploration of the frictions and fits, students reflected on their teams diagrams and also their models of the of their form solutions (fig. 6). Each student translated their understanding into a one-point perspective sketch of an aspect or environmental object indicated in their diagram and model of the system.

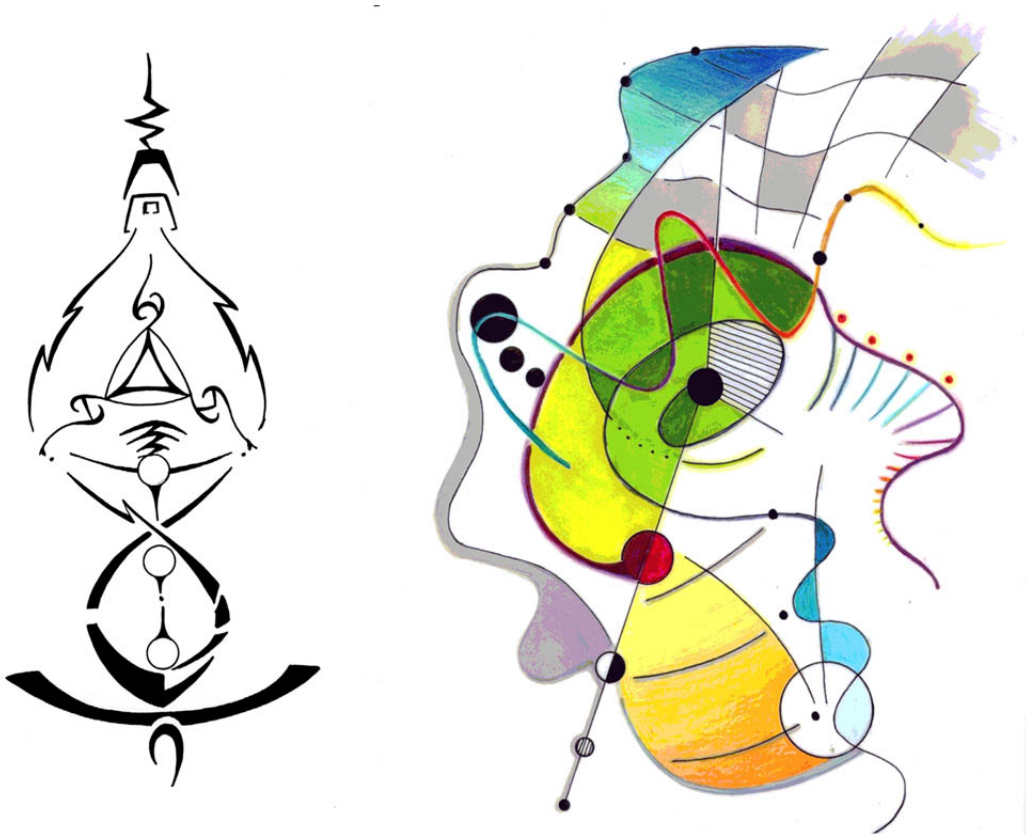

Figure 5 - Final diagram from two different teams. Both diagrams identify a centre where staff are always available, different kinds of activities in certain areas, acceptable diversity of activities in freedom to use equipment in multiple ways in safety, specific addressing of physical and mental limitations and differences.

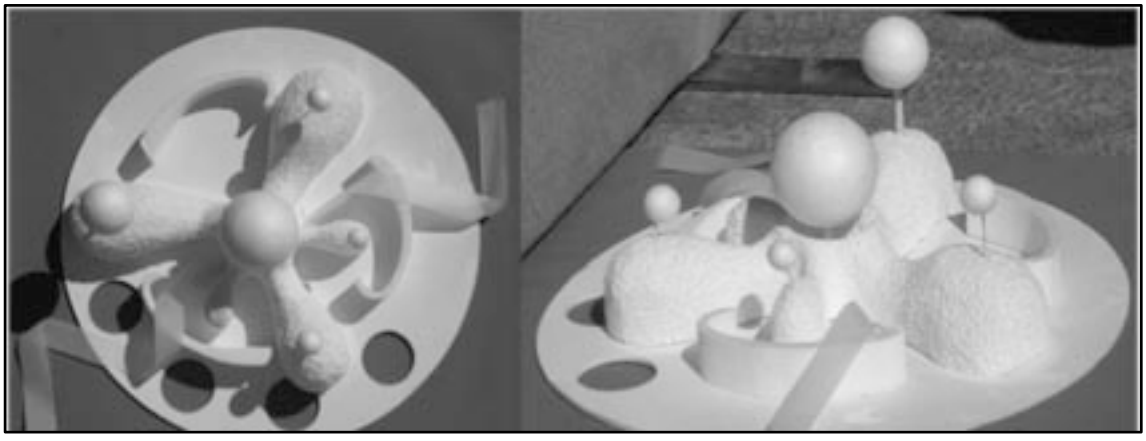

Figure 6 - Final diagram from two different teams. Both diagrams identify a centre where staff are always available, different kinds of activities in certain areas, acceptable diversity of activities in freedom to use equipment in multiple ways in safety, specific addressing of physical and mental limitations and differences.

One student's perspective drawings (fig 7), 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 addressed needs of autistic children who found comfort in having pressure on their bodies. The student chose to develop this

into her graduation project over the objections of one staff member who felt it was too cutesy stylistically, and amateurish. The perspective drawing did have an overall childish quality unlike what was expected from a graduating student. However, there was a consistency with the problem they were addressing. On close inspection the comprehensive addressing of the complexity of the problem, the uniqueness and appropriateness of the proposed solutions were at a level beyond most undergraduate students. It was a highlighting of design education issues, whether design should serve the community needs and seek to solve design problems in a way as to advance human flourishing or just direct students to accommodate commercial interests.

Figure 7 – The graduation project presentation of student's work on the Elizabeth Special School

The student's work was subsequently turned over to the *Elizabeth special school* along with the right to use the intellectual property to develop the mushroom apparatus and the other project outcomes. *Elizabeth special school*, the student, these authors continued to collaborate throughout the project to develop sketches for planning approval. The *Elizabeth special school* chased money for the project. A project leader working with young people at risk in another city council initiative prepared the site and consulted with

an engineering firm 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 vision as it became a reality. Crucial to its actualization was the collaborative processes throughout the project. The overall design for the entire outdoor learning area includes elements not shown. One component of the complete design of the system is the fruit and mushroom elements (fig. 8-9). Another is the sand crocodile (fig. 10). The project was completed and officially opened in a joint government, school and community event, on 11 April 2007.

Figure 8 – Fruit and vegetable in a mushroom cover during the opening ceremonies.

Of particular note was the reaction of the children to this design. Children who were unable or unwilling to engage with the usual playground equipment immediately began using these elements. Staff commented that one particular child who for five years would just sit when forced to be outside now couldn't be kept of the equipment. These children, many of whom need to exercise their physical and mental acuity but are unable to master the usual equipment, responded intuitively to the design. The fruit element was preceded with a working model composed of bags with stuffing hung on a swing set that they never used, until they saw the model. The children mobbed it, destroying the model in a few hours but giving the student enough information to complete the project. The fruit and vegetables were particular appealing to autistic children who needed compression on their bodies.

Figure 9 – Close-up of fruit element

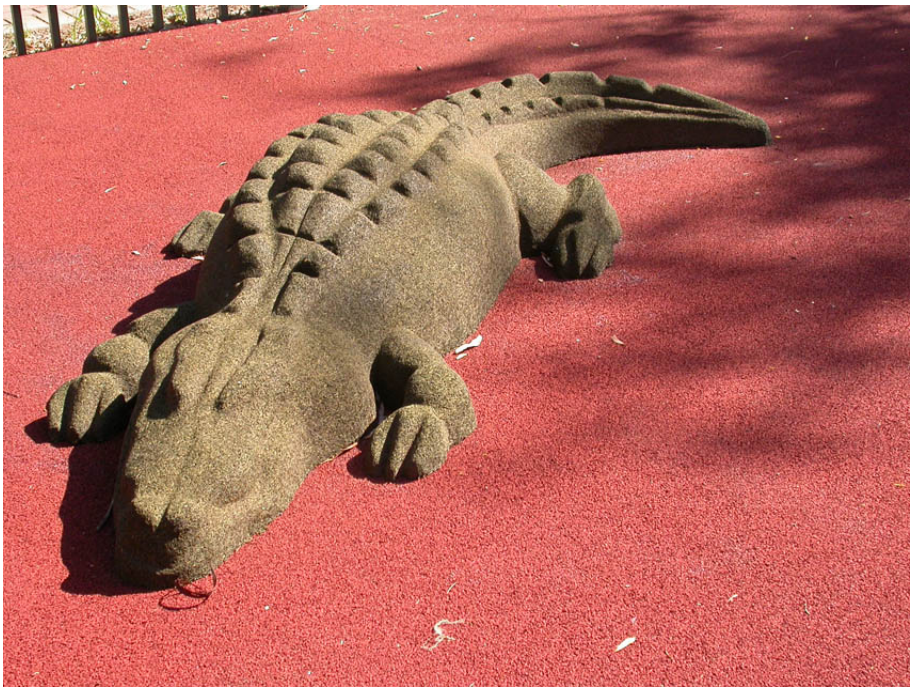

Figure 10 – Sandy appearing crocodile, 2 meters long

6. Conclusions

The project demonstrated that the front end design process resulting in a quality comprehensive design concept can be actualized without compromise through collaborative nurturing keeping to the original vision which can be more easily fostered

when all parties are participants from the initiation of a project. Here multiple stakeholders and intertwining interactions among a diversity of people and systems needed to be considered. The design process here described and followed demonstrated that regardless of the diversity of participants' beliefs or assumptions, a working collaborative can be maintained. This collaborative can be achieved by building a jointly understood 'reality' through a common commitment to an ecological ethic, agreement on a hierarchy of values pertinent to the shared activity; commitment to seeking 'realistic mutually beneficial outcomes.' The overriding principle is one of *mutuality*, and reflects a heuristic exploration of humane and comprehensively investigated design issues leading to elegant sustainable fit between both the designed form and its context.

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