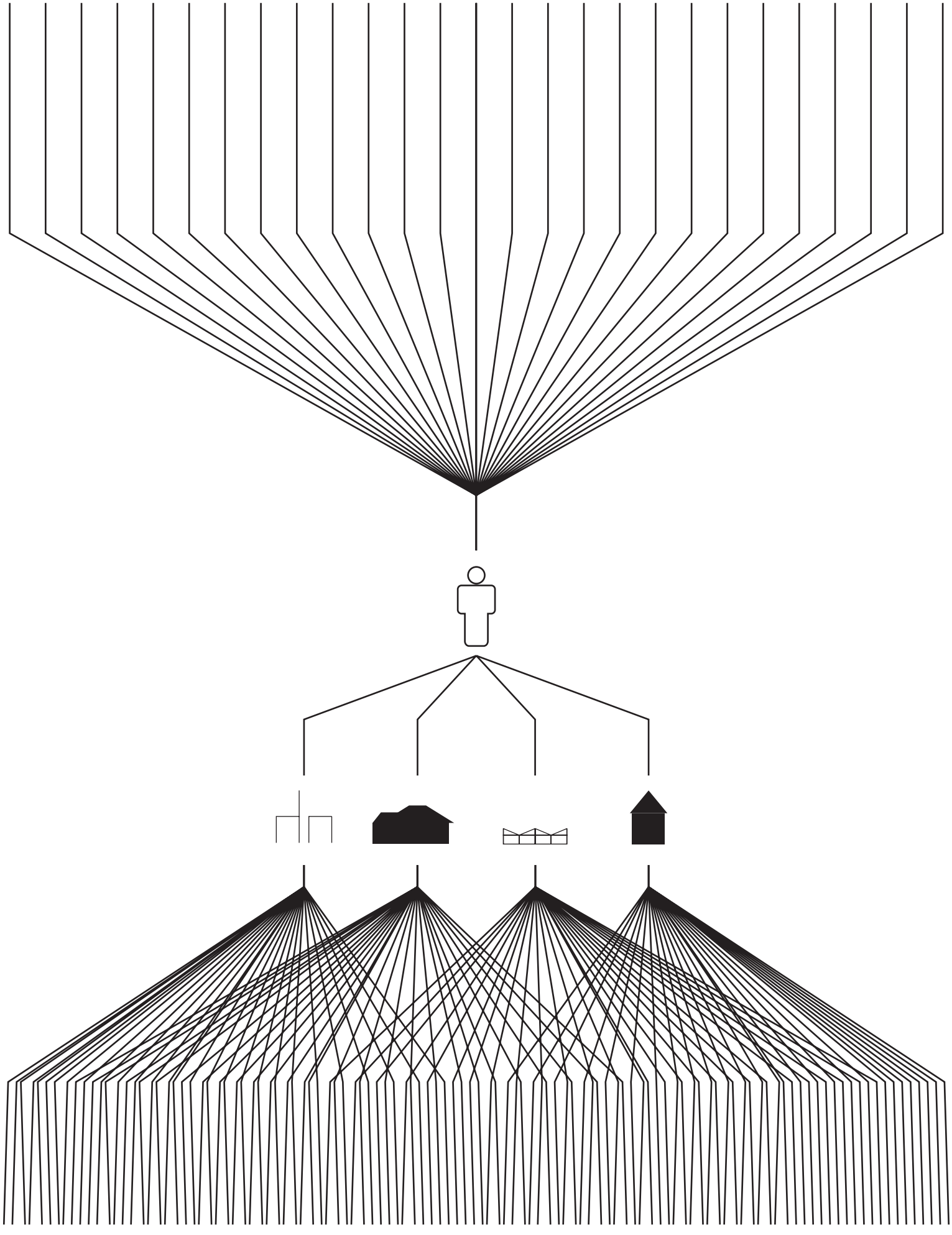

The Importance of Sustainable Design Practices Within Design Education:

An Investigation into Applied Sustainable Design Practices

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ABSTRACT

In today's contemporary western society, we are heading down a path of over consumption and unsustainable design practices. We are starting to do irreparable damage to our planet and if these types of practices are not changed, we are looking at a fundamental collapse of our culture as we know it.

Designers need to look at the things they create through a critical approach as well as being aware of the lifecycles of their projects. Making objects without embedding the product life cycle is no longer good enough as designers must now acknowledge that they are part of the problem of environmental damage.

By focusing on four large scale design projects, this thesis represents a reflection of four different approaches broadly based on sustainable design methodologies: physical, cultural, local, and emotional. A project based approach was taken to explore these areas where objects were conceived, constructed and evaluated based on their sustainable merits.

The overall understanding gained from these projects was that design needs to be Experienced. Design is a practice which operates across multiple disciplines and cultures and the potential good and bad that designers can bring to bear is staggering, and it is very important that design is practiced in a meaningful way.

This thesis also addresses the need for Sustainable design to be introduced very early on within design education. Designers can gain knowledge through practice and through this practical approach, gain insight into how their work can affect others.

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Mom and Dad I love you both. Dad I will miss you.

I'm done!

Dedicated to Charles Dolan 1945-2013.

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1.0 INTRODUCTION

Design is intelligence made visible. — *Le Corbusier*

When I began my thesis on sustainable design practice i did not fully undrestand the breadth and complexity of my objectives. My application started with: "Over the last decade there has been a fundamental shift in the way our global society thinks about the ideas of ecology and sustainability. These are no longer looked at as buzz words for a few but they are the new necessities within all practices. We have come to realize that without serious changes to the way in which we look at our global consumption practices, we will be causing irreparable damage to the planet and that this must change." And although those are my words, I really did not understand how important this introduction would be, in hindsight, to this thesis project.

To look further into exactly what sustainable design was, I realized that I would need to define some key ideas and terms in order to limit my search, as well as to move the search forward. Firstly, I decided to use the Bruntland Commission's definition of sustainability: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Although this is the common definition I think it leaves enough flexibility within it to allow for experimentation.

Another critical idea is what "consumption" and "waste" mean. The Oxford English definition is "the action of using up a resource". Although this is a useful definition, what is much more important to understand is the how we define "overconsumption". One definition from the sustainable dictionary is "the act of consuming something in excess of its ability to be renewed" (Mariano, 2009). In Beyond Growth: the Economics of Sustainable Development Herman Daly, states that "any discovery which renders consumption less necessary to the pursuit of living is as much an economic gain as a discovery which improves our skills of production" (Daly, 1997). I later found out that Daly was actually citing another writer, Kenneth Boulding, who, was the source of the quote. If consumption is such a problem and is directly related to design, how do we create more sustainable consumption?

In today's contemporary culture we are constantly inundated with products, messages, advertisements and trends. We very rarely can go minutes, let along seconds, without someone trying to sell us something, reinforcing what we have bought or telling us the next most wonderful thing which is coming. Our culture is driven by consumption, manufacturing, trade, import and export, all revolving around this idea; if we do not consume our society fails.

Although over consumption causes many problems in our society, such as environmental damage due to resource extraction, damage to water sheds by chemicals used in manufacturing , garbage dumps full of packaging and discarded designs to name a few, it becomes a bigger problem when we export it to other countries. The reality is that human beings do not have a pollution problem, they have a design problem (McDonough, 2013). As a designer, I have come to appreciate that these "things" which we consume all come from the mind of a designer, be it an iPhone, a car, or a kitchen table. All of these "things" need a person to conceive of them. Any

natural system has a means to dispose of the waste. It is only when the waste is unconsidered that it becomes a problem. What needs to be addressed within the design field is this notion of waste and addressing it in a meaningful way.

With this goal in mind I initially wanted to study, experience and produce modular systems to see how this strategy can change and increase the effectiveness of everyday objects. My plan was to develop a system which added extra flexibility and longevity of furniture by allowing infinite configurations and possibilities.

In essence, my goal was to create a utopian design to solve all furniture problems in one neat little package. The focus was going to be 100% ecological and completely sustainable as well. This approach would ideally create an object, or system, which was completely reusable and caused zero impact on the environment, as well as society. Although these were grand ideas they turned out to be less attainable than initially thought. For every method, practice or system there was research disputing its relevance or usefulness within this context.

What became important to realize was that sometimes one just need to begin. My research and project are based on this concept. My strategy was to try and create works where they focused on moving the idea of sustainable design forward if only in small increments. My intention was to combat the idea that "almost every solution designed today even the most sustainable has a more negative impact on the planet than a positive one. This means that the world would be better off if most of what was design was never produced." (Shedroff, 2009). What is necessary is a structure where people create in ways which reduce, elongate and expand the usefulness of objects. This is not a perfect solution but it allows for experimentation and movement rather than sticking our heads in the sand and doing nothing (Shedroff, 2009).

Designers work exists, it gets used, and then is becomes broken, old or obsolete and is then discarded. This is the reality of everything. "Sustainably points to the need to restore natural, social and economic systems, and not merely to fix them but make them perform better." (Shedroff, 2009).

In Designerly ways of knowing Nigel Cross suggests, "the designer is constrained to produce a practical result within a specific time limit" (Cross, 2007) and therefore never perfect. On top of that designers are taught to create "new" when it isn't really better or when "old" doesn't need replacing (Shedroff, 2009). And finally, with "Planned Obsolescence" you end up with a completely unsustainable system which generates massive amounts of waste.

Sustainability cannot be approached through just one avenue; it needs to address people, cultures, needs, desires and the environment as well as the financial mechanisms that makes design possible. Solutions that do not encompass all these principles really do not function and are doomed to fail. Therefore, designers need to find ways to address all these issues and solutions. These three main points are culture, materials, and context (Shedroff, 2009).

This thesis project is an exploration into how designers can be taught to create in much more sustainable ways. The goal is to help change the question of how do we design sustainability

to how do we design so that the two are synonymous with one another, rather than being two different things.

Mike Press writes in The Design Experience the Role of Design and Designers in the Twenty-First Century, that "designers create culture, create experiences and meaning" (Press, 2003), then we need to bring sustainable design into the classrooms and create a curriculum with a foundational understanding of these methodologies and principles. Let's really ask the question of how we get designers to engage with sustainable design practices in a meaningful and practical way. The most meaningful design is culturally and personally relevant and we respond to it on the deepest levels. "The best design also has a future. If it is sustainable." (Shedroff, 2009).

There is a truism which I will be using for the majority of this work and that is, as Richard MacCormac says, "You can't design anything just by absorbing information and then hoping to synthesize it into a solution. What you need to know about the problem only becomes apparent as you're trying to solve it" (1976). This quote is extremely important to the application of the design process. We struggle to think of every conceivable problem and permutation before we even begin the project, but as MacCormac points out, it is only while trying to solve the problem that the true problems really become clear.

The following sections are focused on examining the fundamental principles of sustainable design, the current state of design thinking, and the cultural context in which we work. The four research projects were created to illustrate methods of engagement and potential design theories and outcomes through experiential learning and problem solving while doing.

2.0 LITERATURE REVIEW

2.1 Sustainability

Sustainable design has happened in three waves, first the 1960-1970 green movement. Then the 1980's economic crises and environmental catastrophes prompted a range of legislation and environmental, health and safety standards. In 2000 the third wave has seen things like anti-globalization, trade justice and debt, increasing issues of water scarcity and exploitation. All of these factors help to show the need for more responsible and sustainable practices.

Sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Anon., n.d.) It's always difficult to define something which is so present within the common discourse. Sustainable design has become a series of buzz words which, in most contexts, is almost meaningless; a term which now represents almost anything. Why defining sustainable development is important is that it helps to define what sustainable design should be: designing things which can be can be created, used, reused or disposed of in a way which does not compromise the future generations.

David Orr defines it as "Ecological design: a large concept that joins science and the practical arts with politics and economics" (Orr, 2002). This is a huge mandate as it is the bridge between all disciplines. The essence of sustainable design is not about an individual idea it is about the combination of ideas and the merging disciplines. Often designers hear about ideals of ecological design and how to implement it but do not have the skillsets or information to practice these Ideals.

A number of sustainable design strategies have begun to be used to varying degrees of success. Over time, these systems have started to reach further and further into the common design discourse from the fringe to the everyday. Although some of the practices are subjective, and some are overly complicated, the reality is that they exist to try and create order to a problem which is inherently difficult to quantify. The following are a number of the more successful approaches which need to be addressed.

"Design for disassembly", which is the ability of an object to be disassembled and its parts reused in other objects or configurations. The goal of this type of design is to create objects and structures which allow the materials to be economically and efficiently reused (Billatos, 1997). This methodology would be best practiced by using as much natural material to allow for maximum recycling efficiency. This is most commonly used in furniture making but can be used in all facets of the design practice. The actual discussion of this practice is usually associated with other methodologies but is critical to the understanding of recycling and waste reduction. If you can take it apart then it will be easier to dispose of.

An example of this kind of practice is IKEA. They have really been the pioneers in this kind of

pack flat easy to assemble and disassemble objects. Usually this starts as a method to improve transportation and storage. But it also allows different materials to be separated and recycled rather than sending it to the trash dump.

"Design for efficiency", most commonly thought of as "reduce, reuse and recycle". The goal of this practice was to use more renewable resources as well as minimize the impacts on human health and the environment. In 1987, the United Nations World Commission on the Environment and Development decided that industries should be encouraged to be more efficient. Do more with less.

"Design for effectiveness". This mode of design practice was made popular by McDonough and Braungart in their book Cradle to Cradle. Their main focus is based on using the analogy of the cherry tree as the model for design systems, in that the cherry tree does not produce waste, its leaves are part of a larger system when they die are introduced into the nutrient cycle and all waste becomes food. This is a radical departure from traditional design practices which typically address a cradle to grave methodology; this nature inspired strategy looks at the complete cycle of the design from its inception to its demise with the goal of having a net zero impact on the eco-system (McDonough, 2002).

Climatex® is an example of design for effectiveness as well as a great example of Cradle to cradle methodologies. In 1993, William McDonough and Michael Braungart designed a fabric that could safely return to the environment at the end of its useful life. They analyzed 8000 prospective dyes and chemicals they found that all but 38 could be used safely within their framework. By working with a small Swiss fabric mill, they were able to analyze and reinvent the entire fabric production process. The final product was a toxin-free blend of wool and organically grown ramie, a linen-like fiber. The process was so clean that it generates potable wastewater and the mill turns scrap trimmings into felt which Swiss farmers use for mulch in strawberry fields (McDonough, 2013). This example shows how we can design effectively with a slant, as well as demonstrating how we can use effective design to solve problems of unsustainable waste and consumption.

"Bio mimicry" by Janine Benyus is another method of sustainable design practice. Benyus proposed that design could model itself after nature her goal was to reimagine the design and development process with nature as a source of design inspiration. Bio-mimicry focuses on nature as both model and source of solutions; about integrating into the design practice rather than replacing it. The question asked in Bio Mimicry is "How does nature do that?"(Benyus, 2002).

The Speed-o's Sharkskin-inspired swimsuits worn by Michael Phelps during the 2008 Summer Olympics is a example of biomimicry. The suit seen under an electron microscope resembles sharkskin, which is made up of countless overlapping scales called dermal denticles. The denticles or scales have grooves in alignment with water flow and disrupt the formation of eddies, or turbulent swirls of slower water, making the water pass by faster. In addition to swim suits this design feature/sharkskin mimicry has been added to container ships. This feature is also being applied to surfaces in hospitals because this structure provides creates a surface which inhibit bacterial growth.

"Design for disposal" inserts itself into the "cradle to cradle" methodology. the theory is that we realise that waste is inevitable and designers need to take that into account when they work. The two main goals for this type of practice is to primarily manage waste and secondly to reduce/ minimize waste. In his book Design for the Environment Lewis discusses waste management similar to McDonough but with different goals/strategies/outcomes. Ideas proposed are those of creating objects with finite lifespan and creating objects from materials such as paper and cardboards, while there should be extra care placed on materials such as glass and metals which can take years to degrade on their own.

BioWare is an example of a product which is designed for disposal. The designers recognized that there is a need for disposable cutlery and tableware but also recognized that they need to keep the environment in mind. They used the design process to minimize materials and production methods to minimise their impact on the environment when they are disposed of.

"Design for longevity" is the most interesting type of design practice, Nicole Van Nes and Jacqueline Cramer discuss this Idea in Design strategies for lifetime optimisation of products. This idea takes consumers into account and not only focuses on the methods of production and sale. The thought for designing for longevity is to create a connection to the object, not just through style and fashion but through interest and emotion. This theory is in absolute opposition to the idea of "planned obsolescence". The goal would be to create something, for example a table, which you will never need to replace. This would have been common in the pre industrial revolution period of design where you would not look for style but function and quality. Temporal longevity is not the only way to design for longevity, but modular systems also fall into this practice as well. The goal would be to create works which divide fast and slow developing technologies, division of fast and slow moving parts, changeable appearance, etc. The most important part of this practice is to allow the owners an attachment to the design beyond a physical one and to try and create and enduring satisfaction with a product/design, rather than only meeting the momentary desires of today (Nes, 2003).

Razer Project Christine is an example of this type of system. The computer is a modular component hub where the CPU, GPU, RAM all are swap able. The central core is static and all components attach to it. This system allows for components to be upgraded as needed without need for the whole system to be replaced, like current laptop and tablets are.

There are also some business practices, which will help designers to understand how they can be a positive in the business world.

Natural Capitalism (Hawken, 1994) by Paul Hawking, Armory Lovins, and Hunter Lovins. This approach focuses on the rethinking of the social and natural resources in the context of business. The system is based on three pillars: natural capital, human capital, and financial capital. Natural capital is the use of the natural resources we get from the earth. These include physical things, such as materials and energy, as well as processes and efficiencies, such as ecosystems, services, and resiliency due to bio diversity. Human capital is the value we get from the work and ideas contributed by people. Manufactured capital describes the material and energies people create through industry that isn't found in nature. This includes intellectual property and is where the bulk of the value contributed by designers is found. Financial capital is money and the many

forms it come in. Finance is an incredible invention that allows us to use and invest in the other forms of capital in more effective and innovative ways.

Natural capitalism has four goals. Goal one is to dramatically increase the productivity of our use of natural resources, and correspondingly reduce the material and energy intensity of the products and services we create and use. Goal two is an ecological redesign; a shift in our perspectives and processes towards more biologically-inspired models. This can be anything from a new material to a new process. Goal three is in regards to service flow economics; a shift from products to services and from objects to outcomes. Goal four is the investment in natural capital to build a stronger resource base, as well as a more resilient world. Try and create more sustainable resource use.

Another common form of design practice is called Planned Obsolescence. "Deliberate obsolescence in all its forms – technological, psychological, or planned – is a uniquely [North] American invention. Not only did we invent disposable products… but we invented the very concept of disposability itself, as a necessary precursor to our rejection of tradition and our promotion of progress and change." (Slade, 2006). This is the idea that designers deliberately plan for there works to become obsolete with an attempt to increase sales or production.

Planned obsolescence has its roots at the turn of the twentieth century. During the roaring 20's, there was a feeling of freedom and exuberance about the new century and the technologies being developed. This explosion of sales and production had a twofold effect: first, there was a rapid expansion of production capacity all across America, and secondly the rapid implosion of the economic system when demand dropped off, which was commonly referred to as "The Great Depression". The causes of the Depression were varied and no one factor led to the complete collapse of the American economy.

In 1932 during the middle of the depression a document was released by Bernard London called "Ending the Depression through Planned Obsolescence." This was one of the first times that the term Planned Obsolescence was used. The initial idea presented by London was very different to the one currently being used by big business. His idea was:

…have the Government assign a lease of life to shoes and homes and machines, to all products of manufacture, mining and agriculture, when they are first created, and they would be sold and used within the term of their existence definitely known by the consumer. After the allotted time had expired, these things would be legally "dead." (London, 1932)

The world view of the time was not as it is now, of a shrinking ecosystems and giant mounds of garbage (London, 1932). Definitions of obsolescence comes from the original mention of Planned Obsolescence: "A product or procedure is obsolete, presumably, when something emerges which is better. Admittedly, 'better' is not always easy to define." (Nelson, 1967) This initial observation by London sets up the modern version of this practice. This idea of "better".

The current explanation by Paul Gregory says "Purposeful obsolescence exists whenever manufacturers produce goods with a shorter physical life than the industry is capable of producing under existing technological and cost conditions; or whenever manufacturers or sellers

induce the public to replace goods which still retain substantial physical usefulness." (Gregory, 1947). Planned Obsolescence is one of the most significant drivers of consumption in our culture today. Every element of our society has in some way been affected by this practice.

"Life cycle analysis" developed by the Environmental Protection Agency(EPA) is another system for analysis and could be one of the most precise frameworks for assessing solutions and the viability of designs from an ecological perspective as it is entirely quantitative. The strength of this type of approach is that it is comprehensive and objective. Where it lacks is that it is easier to measure existing products and services, versus proposed ones because usually things change during production and transportation to final place of use. The focus of Life cycle is to compile an inventory of relevant energy and material inputs and environmental releases and evaluate the potential environmental impacts associated within identified inputs and releases. Interpreting the results will help make a more informed decision about the environmental impact of the thing you are using.

Lastly there is "the natural step" which is based on four systems which can be used to stabilize the environment. The strength of the natural step model is a development and business positive approach seeking to help organizations choose better options so that they reduce their impact on the environment.

Firstly, eliminate contribution to the progressive buildup of substances extracted from the Earth's crust (for example, heavy metals and fossil fuels). Secondly, eliminate contribution to the progressive buildup of chemicals and compounds produced by society (for example, dioxins, PCBs, and DDT). Third, eliminate contribution to the progressive physical degradation and destruction of nature and natural processes (for example, over harvesting forests and paving over critical wildlife habitats); the fourth point is the analysis of systems conditions the physical basis for the productivity and diversity of nature must not be systematically deteriorated. Productive surfaces of nature must not be diminished in quality or quantity, and we must not harvest more from nature than can be recreated or renewed. Lastly, eliminate our contribution to conditions that undermine people's capacity to meet their basic human needs (for example, unsafe working conditions and not enough pay to live on).

Janis Birkeland (Benyus, 2002) encapsulates this by presenting change in the following list of what it means to design sustainably, as Tracy Bhamra and Vicky Lofthouse wrote in Design for Sustainability it is "a new vision for design" (Bhamra, 2007).

Design for sustainability (Benyus, 2002):

1. Responsible – redefining goals around needs, social/eco equity and justice
2. Synergistic – creating positive synergies; involving different elements to create system change.
3. Contextual – re-evaluating design conventions and concepts towards social transformation.
4. Holistic – taking a life cycle view to ensure low impact, low cost, multi-functional outcomes
5. Empowering – foster human potential, self-reliance and ecological understanding in appropriate ways.
6. Restorative - integrates the social and natural world; recultivates a sense of wonder.

7. Eco-efficient – proactively aims to increase the economy of energy, materials and costs
8. Creative – represents a new paradigm that transcends traditional boundaries of discipline thinking; to "leapfrog".
9. Visionary – focuses on visions and outcomes and conceives of appropriate methods, tools, and processes to deliver them.

There has been a significant change in thinking within the practice of design these steps have helped us to start looking at the world we live in and work in not as passive actors but as implicated participants.

2.2 Design Thinking

"The natural sciences are concerned with how things are… design on the other hand, is concerned with how things ought to be." (Simon, 1996). Design thinking is not limited to the creative arts or architecture; it is a way of approaching problem solving, often focusing on lateral creative thinking within the domain of sustainable design.

Designers learn about the nature of a problem largely as a result of trying solutions, whereas scientists set out specifically to study a problem. "Scientists problem solve by analysis, whereas designers problem-solve by synthesis" (Cross, 2007). The key to this difference is the creative practice of design and the time constraints. Cross rightly points out that "The designer is constrained to produce a practical result within a specific time limit, where as the scientist and scholar are both able and often require, to suspend their judgements and decisions until more is known - 'further research is needed' is always a justifiable conclusion for them" (Cross, 2007). In design, the time constraint is part of the problem which must be worked within

Design thinking is based on constructed/experiential knowledge. Designers learn by doing. The idea is that knowledge is not fixed and immutable elements of thought but formed and reformed through experience (Kolb, 2005). Constructed knowledge is critical within the creation of design thinking. John Dewey makes a distinction between a primary and a secondary experience and how these types of experiences help to create knowledge. The primary experience is composed of material interaction with the physical and social environment (Dewey, 1929). In other words, designers require application of theory to truly understand something, we cannot truly understand the benefits of materials, processes or theories until we try it. Understanding the benefits of wood working versus metal, or why hand made is better in some cases, then computer numerical control (CNC) all of these things become visible as you try them. The secondary experience, as Dewey mentions, is a reflective, looking back at experience and learning from it. Combined, these two methods help to create better understanding of the environment. It is the failure and uncertainty of the primary experience that gives rise to reflective thought and learning. Design thinking needs to embrace both methods of learning and understand that both methods are valid. Certainly, we often learn more by our failures then we do from our successes.

Design thinking needs to address multiple levels of learning because it is not straight forward. It is not just knowledge and skill progression but how learning to become a designer involves "working in a different way" such as different ways of looking at situations, and products (Lawson, 2009). Designers need to be exposed to as many different ideas as possible where

one can expand the argument and counter argument to problems large and small in order to actively and constructively create work.

This understanding, that humans have the ability to see something, to perceive what it is and to be able to recognise it as something, draws on our experience of the world we live in, our multi-sensory perception and cognitive faculties at interpreting what is going on around us. We engage in midenic reasoning, "reasoning in the middle of doing things, reasoning in the midst of reasoning about what we are doing" (Livingston, 2008) (Luck, November 2012). In other words, we learn by doing. Design experience is based on the fact that the action of creating designs allows us to understand the practice better.

Consequently, the act of problem solving within the practice of design can be an extremely difficult thing to define without actually creating. For the most part, the nature of the problem can only be found by examining it through proposed solutions. Until you actually put a potential solution into practice you may not understand the entire problem being presented. The key is to not only look at one option but to take on the approach from a series of angles. If one looks at a problem from at least two (ideally more) radically different directions you get a much better insight into what is being asked. The comparison of two or more solutions presents a clear picture of and the 'real-nature' of the problem is revealed. This type of design practice encourages the ability to generate and test many different solutions and consequently it allows the designer to become critical about the appropriate solutions (Cross, 2007).

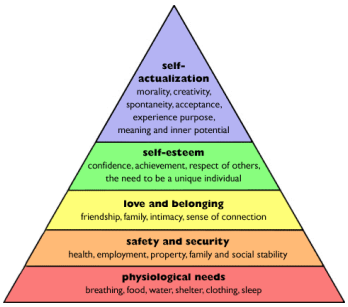


Figure 1 – Maslow's Hierarchy of Needs

2.3 Consumption

Over the last century there has been a fundamental shift in the way in which we consume. The necessity for economic growth and technological advancement has completely eclipsed the environment and the detrimental effects of mass consumption and waste. As the world has gotten smaller and populations have exploded, resource demands have exponentially expanded as well. We no longer live in a world which has limitless amounts of natural resources and abyssal sinks in which to dispose of our waste. We treat the environment not only as an unlimited store where everything is never-ending and practically free, but also as an unlimited trash dump (Shedroff, 2009).

To understand sustainable design practices it is important to understand the effects design can have on consumption. Consumption is not only a way of life; it IS life (Chapman, 2005). This idea of consumption works from a very primitive part of our psyche. Once, as Abraham Maslow mentions in his hierarchy of needs (Fig 1.), we have fulfilled our physical needs, we begin to address our psychological needs, which some argue is where our needs to have the most up to date fashion accessories come from, the psychological need to fit in and position oneself within society (Maslow, 1943).

Within the design context, some would argue that consumption and waste are a result of marketing which creates artificial demand for things we do not need and increase loyalty to a given product. Giles Slade writes in Made to Break, "Before consumer ads could become effective in creating a demand for a product, the product had to be differentiated in some way

from similar goods (Salen, 2003)." Designers need to understand what they are doing and how that can be problematic for the environment and resources.

A contemporary example of this would be the ubiquitous cell phone. By 2002 over 130 million still-working portable phones were retired in the United States. Cell phones have now achieved the dubious distinction of having the shortest life cycle of any electronic consumer product in North America, and possibly the world at this point. In Japan, they are discarded within a year of purchase (Salen, 2003)It is not function that is retiring these products but the lack of appeal, the iPhone 4 is obviously not as good as the iPhone 4S, and of course nowhere near as good as the iPhone 5. The reality is that the iPhone 1 probably does everything the average user needs.

Although it is easy to write about the computer industry and Apple computers in this context, the reality is that they are symptoms, not the cause. These types of practices go farther back than Steve Jobs and Jonathan Ive. Some would say that the Coldspot refrigerator designed by Raymond Loewy was the start. His skinning of this fridge completely revolutionized the house hold appliance market and radically changed the way our culture perceives the things we own. We began to see the thing we owned as more than just function, but now also by style.

In Design Research Now, Gui Bonsiepe points out that, "The designer observers the world with an eye to its designability... The designer gives people an opportunity to have new experiences of aesthetic character..." (Michel, 2007). Consequently the main skills taught to designers are creativity and lateral thinking.

According to George Nelson, a designer is someone who does not have an identifiable profession. Anyone who plays a key role in product creation and development has a design function and the designer has a lot to do with obsolescence rates because they are temperamentally unable to leave things alone. To a designer, anything that is, is obsolete (Nelson, 1976). The reality is that designers need to understand that there is more to designing something better than just basing it on it technical merits. Its physical, social, cultural and emotional merits need to be addressed as well. Sometimes it better to leave the iterating model and look for real change.

Unfortunately, because consumption is such a necessary part of our culture, we cannot just stop consuming. We need to find smarter ways to produce. As Herman Daily writes in Beyond Growth, "Any discovery which renders consumption less necessary to the pursuit of living is as much an economic gains as a discovery as one which improves our skills of production. Production – by which we mean the exact opposite of consumption, namely the creation of valuable things – is only necessary in order to replace stock pile into which consumption continually gnaws" (Daly, 1997). We need a transformation in the way we value objects, from their construction to their perceived value, as well as the way we replace those objects and dispose/recycle them.

2.4 Cultural Context

Good design is as little design as possible.'— Dieter Rams

Everyone is a designer. All that we do, almost all the time, is design, for design is central to all basic human activity. The planning and the patterning of an act towards a desired, foreseeable end constitute the design process. Any attempt to separate design, to make it a thing-by-itself, works counter to the fact that design is the primary underlying merits of life (Papanek, 1985).

The main question for the designers thus becomes not what can they create, but how to reinvent design culture so that worthwhile projects are more clearly identified and likely to be realized. Just as other professionals are finding ways to earn their living in the culture of sustainability, designers will have to create new forms of practice. The first step is to recognize that design has historically been a contingent practice rather than one based on necessity. Designers make choices in response to particular circumstances and situations, and ignore other possibilities (Margolin, 1998).

Contemporary culture is trying to live sustainably at an exceptionally high standard of living (Fuller, 1982). Over this last century we have started to lose appreciation for the things we use every day. Our objects have become things we use only until we find something to replace them. We have moved from a culture of permanence, to a culture of the disposable. In a society driven by quick turnover, repeat sales, and maximizing profits, it has becomes very difficult to combat these types of practices (Gregory, 1947).

Jonathan Chapman sites Marcel Wanders in saying that "engagement has become a rare commodity... [Designers] lack a common purpose. Design has become a practice without content, geared towards surface appearance and financial success" (Chapman, 2005). Designers need to find a common purpose and move forward as a group and not as individuals.

Design is the conscious and intuitive effort to impose meaningful order (Papanek, 1985). This lack of engagement and /or attachment has caused us to treat the environment not only as an unlimited store where everything is never-ending and perceived as practically free, but also as an unlimited trash dump. This isn't a localized phenomenon, it's a human condition. People will always need more, once we have filled our basic needs we work towards our wants. It is within our nature to strive for more, as Robert Browning wrote, "a man's reach should exceed his grasp". Contemporary culture has embraced this motto and uses it daily. But in embracing this ideal we have started to create systems which are impossible to sustain.

The fact is that 80% of products are discarded after a single use and 99% of materials used are discarded in the first six weeks (Weizacker, 1997) (Bhamra, 2007). This is a design problem, either because products are no longer regarded as long term artefacts, or the fact that designers have not taken into account that what they do must be designed to be disposed of.

Forcing people to change is not realistic and may be detrimental. Chapman speaks to this, saying that, "essentially, change will not be brought about through telling people what they can

and cannot do; the likelihood of change will only occur when alternatives emerge that propose a more attractive solution to the one currently adopted (Chapman, 2005).

Orr said when defining the requirement for ecological design that it "...requires not just a set of generic design skills but rather the collective intelligence of a community of people applied to particular problems in a particular place over a long period of time." (Orr, 2002). Design is about moving forward the inherent methodology of the design practice. There will be errors and mistakes but we need to address how we move forward from those mistakes.

Achieving a sustainable standard of living for all people requires a bold new approach: an environmentally-responsible global system to confront these problems. A large variety of techniques can be used to accomplish this goal. Greater efficiency in the use of the earth's limited resources, minimization of waste, and fundamental changes in production processes are some methods that can be employed (Margolin, 2002). This is a problem designers are well situated and equipped to deal with, as Bill McDonough said, "designers create meaning and culture" (McDonough, 2005).

Part of the challenge for designers is to fully understand the scope of the problem and appreciate what can be tackled under the umbrella of design for sustainability. Within the design community there is a general lack of awareness of many issues relating to sustainable development. Designers need to understand and communicate to their colleagues that design for sustainability is about more than recycling or using recycled materials (Bhamra, 2007); it is about a shift in thinking towards a larger question.

This broad mandate is then divided into six themes: quality of life; efficient use of natural resources; protecting the global commons; managing human settlements; the use of chemicals and the management of human and industrial waste; and fostering sustain-able economic growth on a global scale (Margolin, 1998). This type of practice must be started and attempted, not just pondered.

For the first time in several decades, consumers are looking for quality, lasting value, and simple no-frills products. The public seems willing, when able, to pay a little extra for a cooking pot that will last twenty to thirty years, a well made bicycle, well crafted furniture, or decent tools (Papanek, 1985). This is not limited to long lasting objects, but to "green" or sustainable objects as well.

This is not only limited to the individual, but nations are also taking on these mandates and moving them forward. In the European context (and to some extent in the USA and Japan), regulations and policies to increase environmental protection appear to have become a new stimulus for innovation and to have led companies to identify new business opportunities. (Lewis, 2001). This is where designers live and thrive.

2.5 Literature Review Conclusion

Forcing people to behave more sustainably is problematic; if we offer better solutions which

make them feel better, we will achieve more sustainable results. Designers must use a variety of methods to help our society become "less bad" (McDonough, 2002).

Designers think about the world differently than people in other fields. They are always concerned with how things could be, look at the world for its potential and not for just how it is. This perspective allows designers to be the perfect ambassadors of sustainability because it is not a well understood and in its infancy and designers play a key part in what consume. Designers are involved in the creation of almost every contemporary object. The key to this process is that the very nature of the practice of design focuses on the ability to start without all the information and come to a conclusion. Right or wrong, this allows for access points to ill-defined problems where others may not have the confidence or ambition to attempt such solutions.

If our culture is not going to change, or can't change, the way it consumes because of its necessity to economic functions or practices such as Planned Obsolescence, we need to tackle the issue of unsustainable consumption by addressing the things we consume. By creating new methodologies for the creation of sustainable designs, we open the possibilities for new and innovative products. This can only happen if we begin to inform designers early on about the extent to which they can be a benefit or a detriment to future generations. There needs to be a focus on the benefits of obsolescence, planned or otherwise, as well as an introduction of different processes to help designers succeed in practicing these types of strategies without a focus on success, but rather a focus on the attempt.

We need a change the fundamentals of design culture as well as the overall culture of consumption and product development if we want everyone on the planet to have a similar standard of living, we will need to change the way they utilize their skills to create. We need to embrace that we are now a disposable culture and the truism that eventually whatever we design will end up not being used by the original owner or thrown out. It's important not to stop there, but to imbed that thought process into all objects. Whatever we design is no longer useful if it cannot be disposed of in a way that has little to no impact on the environment.

The sustainable design revolution is happening. Although relatively new, it is becoming more and more valued within design thinking. Some of the ideas and practices are confusing and subjective but have merit, even if inconsistent. These practices still come from a positive and constructive place, and as designers we need to make these kinds of positive steps. The current literature on sustainable design research tells us there is a need for a new approach to design. Although this is a large topic, there are many different avenues for investigation and any direction can yield results, versus doing nothing. Designers need to have a considered approach to their practices. Where in the past design was about making things look beautiful, it is now about understanding that things have a finite life and that life cycle must be considered from their inception.

The ideas of sustainable design practices must be brought to the forefront of design education so that they become imbedded in the practice.

3.0 Research Introduction

A fundamental question designers ask themselves every day is, "How can we change the world?" Although many fields have the same thought, designers are the few who actually can do it, be it through a poster to adjust opinions, furniture to change comfort, architecture to modify society or anything in between. Designers have the ability to change the way people perceive the world and interact with it, unlike any other profession.

Practicing correctly, designers can create understanding. Designers are at the beginning of a cultural shift from that of abundance to one of scarcity. The importance of this transition will dictate the future of our way of life. It is important for designers to understand their position in the world and how they can affect it and therefore it is critical that designers get access to how to design sustainably as they begin to practice.

As Nathan Shedroff writes in Design is the Problem, "The sad truth is that almost every solution designed today, even the most sustainable has a more negative impact on the planet than a positive one. This means that the world would be better off if most of what was designed was never produced (Shedroff, 2009)." That being said, what needs to be realized is that sustainable design practices are not the most straight forward or easy to understand. Often, for every answer, there is another opinion which is contradictory.

There are two sayings which I think need to be addressed: "The road to hell is paved with good intentions" and "the journey of a thousand miles begins with a single step". The examples of the Prius and Hummer, along with a million other products and designs have showed that people will be critical of any practice which is supposed to be "better" than what we have. Whether or not these ideas are true, the important aspect is that people are trying new things. As George Nelson wrote in Obsolescence, "A product or procedure is obsolete, presumably, when something emerges which is better. Admittedly, 'better' is not always easy to define." (Nelson, 1967).

For example with the Toyota Prius versus the Hummer, many would agree that the Prius is a better choice for the environment than the Hummer, but the reality is it is not a yes or no question (Gleick, 2007). In Dust to Dust they make a pretty convincing argument for the Hummer, looking at the entire lifecycle of the Prius as well as the Hummer: because of the Prius's computers/ technology, as well as the batteries, its overall effect on the environment is much more harmful that the traditional low tech Hummer, so consequently there have been a number of other papers refuting the methodology of their findings, citing that they cherry picked the data they wanted. There is a lot of controversy over this question as many people have come in on either side of the argument. The only thing that can really be taken from this question is it has opened up a dialogue about how and what makes effective sustainable design. The attempt was to create a more environmentally friendly car. Whether they succeeded or not, the important aspect is that they attempted to develop a completely new design.

The goal of these projects is to create works and personal understanding in the field of sustainable design, in order to help broaden the understanding of sustainable design beyond just

reading and writing about it. It is about the application of lateral thinking and problem solving which results in tangible objects with a basis in sustainability. The realization that nothing is permanent, that nothing lasts forever and the journey of a thousand miles begins with a single step. And this is a starting point.

It is important to understand that designers are not coming at this idea of sustainability from the same direction as other faculties. Nigel Cross has an interesting perspective on this in that "the natural sciences are concerned with how things are, while design is concerned with how things should be" (Cross, 2007). In design things must be tried.

The question boils down to how we get designers to engage with sustainable design practices in meaningful and practical ways. It is said that "the most meaningful design is culturally and personally relevant and we respond to it on the deepest levels. The best design also has a future. If it is sustainable." (Shedroff, 2009).

For this thesis i have created four projects, which attempt to be sustainable. The first three projects function to explore three different aspects of the design practice which help to create more sustainable work as well as limiting the amount of waste: Social, Physical, and Contextual. The forth project focuses on the personal and Emotional sustainability.

3.1 Methodology

The intrinsic problem in trying to do design research is that the field of design is so relatively new. There are a number of problems in trying to equate design to a science in that design is not a science, or literature, or any of the other disciplines already existing within academia, although that is traditionally how academic research is done. By trying to create these associations there is an attempt to shoehorn different methodologies into the design practice and in the process, removing some of the most important elements of design because non-designers have no use for them in other disciplines.

Research is systematic enquiry, the goal of which is knowledge. When we learn we need to engage with the subject matter, not just with the theory but in Research/creation. It is commonly understood that designers learn about the nature of the problem largely as a result of trying solutions, whereas the scientists set out specifically to study a problem; design problems are notoriously hard to lock down and designers need to approach a problem with an open mind. "Scientists problem solve by analysis, whereas designers problem-solve by synthesis" (Cross, 2007). Because there is usually no "right" answer to any design problem, the emphasis becomes the process and the lessons learned throughout that process.

Victor Papanek writes in Design for the Real World that, "Design is a problem solving activity and can never, by definition, yield the one right answer: it will always produce an infinite number of answers, some "righter" and some "wronger". "The rightness" of any design solution will depend on the meaning with which we invest the arrangement." (Papanek, 1985). This is extremely important to design education and to design practice in that the goal is to try, and success cannot be based on right answers, but rather should be based on the application of the process.

"The designer observes the world with an eye to its designability, unlike scientists who regard it from the perspective of cognition. The scientist and researcher generate new knowledge. The designer gives people an opportunity to have new experiences of aesthetic character, which in turn are subject to a socio-cultural dynamic. The tension between cognitively related activity (research) and non-cognitive research activity (designing) becomes apparent here. To avoid misunderstandings, however, it should be pointed out here that design activity is increasingly permeated by cognitive processes. This also raises the issue of mediating between these two areas…" (Michel, 2007). It is this type of design practice where we have to recognise that there is a need for the research and practical application as well; but all too often the slant is too far towards cognitive research and the practical research is regarded as less significant or relevant because the philosophical and intellectual practice is only present in the research portion and not present in the practice. This balance is critical in good design practice, the understanding that the research doesn't exist without the practice and vice versa.

The practice of design can be defined as one which focuses on constructed methods of learning. It is not expected that the designer know everything, but it is expected that they are open to trying new things and learning from their practice. They are also expected to be reflective on what they are doing as well as being critical of their own practices.

The most important aspect within the practice of design and design research is not the end

result/product but the path to that outcome. Understanding how one arrived at an answer is critical. This is the area where the most relevant practice of design is used. This process allows designers the opportunity to understand the work through a critical approach by someone who has been there before, but also, more importantly, through self discovery. By removing oneself from the problem and looking for contradictions or problems, one begins to understand the different elements of the process. This approach helps not only in finding solutions, but also in finding reasons why a particular solution is the best approach to the work.

If design is inherently created through the practice of creation and knowledge must be created by doing, how does one document or communicate that research to others? There are two ways of approaching this problem. First, one can approach the design practice through the investigation of design epistemology, or the study of the practice of how others design; an investigation of their knowledge.

Design problem solving really only exists as you are working through the process of trying to find a solution. It is not a process where you can just inform yourself through literature or other forms of passive information acquisition, the act of "doing" informs the process and the ability to see the flaws in the process and these issues only really become obvious as you are trying to solve them.

Research within design therefore needs to involve both sides of this problem: the praxis and the epistemological must both be explored. Much like the practice of design itself, only by looking at the problem from two very different sides can one truly understand the question.

Some design researchers think that there is a need to draw a distinction between works of practice and works of research. Sometimes it is extremely difficult to see how standard works of practice can be regarded as design research through traditional eyes. Designers need ideas, not always hard facts, so "reliable knowledge" is often subjective. One of the dangers in this new field of design research is that researchers from other, non-design disciplines may import methods and approaches that are inappropriate in developing an understanding of design. Rather than reliable knowledge, design should focus on "situational knowledge".

The key to understanding design research is to observe, to try and to evaluate so research can be as simple as just making information or observations available for others to review. Sometimes seeing how others have attempted a problem is as valid as doing it yourself. Design research can be a well-defined and explored problem with a series of outcomes documented through process, construction and finally through documented reflection. By taking this type of approach, one can expand the knowledge of other practitioners by either exploring the answers first or by making mistakes and allowing others to know what they are so that they may avoid them.

Design problems are not the sort of problems or puzzles that provide all the necessary and sufficient information for their solutions. Often there are fundamental points left out of the problem, along with relevant information that can only be found by generating and testing solutions; some information or "missing ingredient", has to be provided by the designer himself. This is only usually discovered through the act of making and experimentation with materials and configurations of objects, elements or media. This act of experimentation through doing reveals key questions and abilities which may not be obvious by just reading or analyzing existing

objects.

Design methodologies vary vastly from the heavily academic anthropological to the very practical. This is why design is a practice which can exist in many worlds. Traditionally, design teachers have been practicing designers who pass on their knowledge, skills and values through a process of apprenticeship. Design students act out the role of the designer in small projects, and are tutored in the process by more experienced designers (Cross, Designerly Ways of Knowing (Board of International Research in Design), 2007). This traditional role of applied making is extremely important in the training of potential designers. It very quickly allows students to understand the complexity and difficulty of making; designers need to practice to learn. The practice of design cannot be empirically verified or discounted.

Nigel Cross talks about this by setting out how designers should look at design problems, noting that, "In order to cope with ill-defined problems, designers have to learn to have the self-confidence to define, redefine and change the problem-as-given in the light of the solution that emerges from their minds and hands. People who seek the certainty of externally structured, well defined problems will never appreciate the delight of being a designer." (Cross, 2007). The joy in defining and creating the question is much more interesting that the solution. Once you have the question sorted, the answer becomes clear.

Within the design practice, the nature of the problem can only be found by examining it through proposed solutions. The act of making allows one to begin to understand the complex nature of the problems. Until you actually put a potential solution into practice you may not understand the entire problem being presented.

Firstly designers tackle "ill-defined" problems. This is important because it points out that the interpretation of the problem is important. Designers are asked not only to follow the instructions, but to also understand what is being asked of them. Sustainable design is a very good example of how one can define an "ill-defined problem" (Cross, 2007).

The second point is that designers' mode of problem solving is "solution-focused", the understanding that there is always a solution to every problem within the practice and research and that these solutions help to inform the next solution. The ability to understand that the process of design is never finished and is always extremely useful.

The third point is that a designer's mode of thinking is constructive. There should always be a tangible outcome from every work project. The act of creation in the physical or digital allows for better understanding of the problems.

The goal is to not only look at one option but to take on the approach from a series of angles. Design theory tell us that if we look at a problem through one view point, this can limit the possible outcome and understanding of the problem. If one looks at a problem from at least two radically different directions, one acquires a much better insight into the practice of design.

The comparison of two or more solutions reveals a clear picture of the 'real-nature' of the problem. This type of design practice encourages the ability to generate many different solutions

quickly and thus allows the designer to become critical quickly about the appropriate solutions (Cross, 2007).

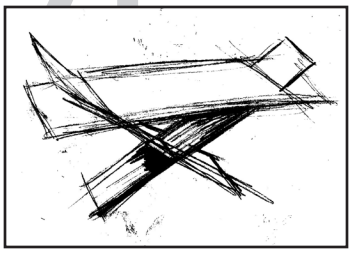
As mentioned there are two fundamentally different ways of looking at design process: those of rational problem solving (a goal oriented problem solving process) and reflective practice (a process of learning). Design methodology is based on logic, rationality, extraction, and rigorous principles. The practice of design is an orderly, stringent procedure which systematically collects information, establishes objectives, and computes the design solution, following the principles of logical deduction and optimization. It is used as a methodology to bring order to problems which are inherently difficult to define (Dorst, 2008). This is the approach used for this thesis. The goal is to present four projects of varying scale which were chosen to reinforce the notion and importance of sustainable design within the education.

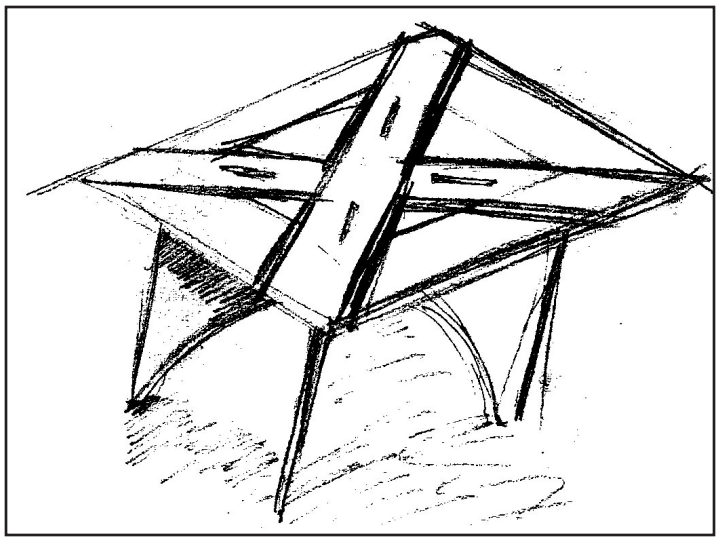
The objective is to engage with these two methods of design practice. First, through the exploration of a physical based project (rational problem solving). These will be based on investigating one of four established methods of sustainable design using either emotional, cultural, material or context as the starting point for the project.

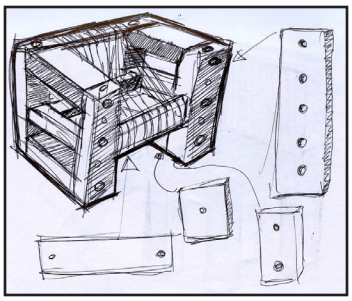
This exploration will allow for multiple entry points into the subject and topics for discussion. For example by creating a Chair I gain insight into how one looks at form, construction methods and techniques, and material sustainability. Rather than just focusing on one element, this approach allows for the development of the designer interest, as well as allowing for a better understanding of how one can integrate sustainable design.

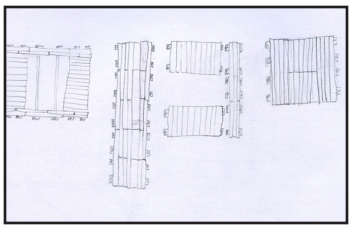
The key to creating knowledge or assimilating something is to find ways to engage with the subject in a personal and meaningful way that can be repeated with other projects or other subjects. This is the methodology followed throughout my research.

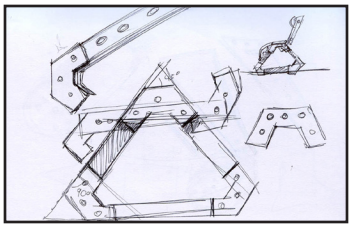
3.1 Modular Chair – "Physical" Sustainability ~ Idea

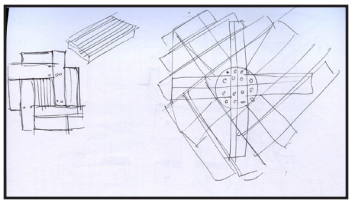


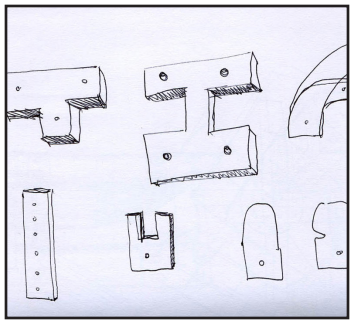


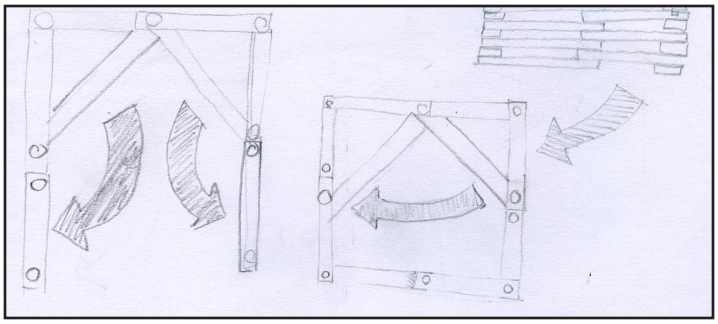


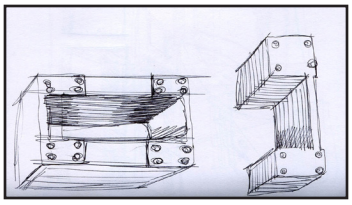


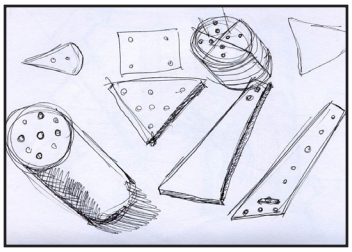


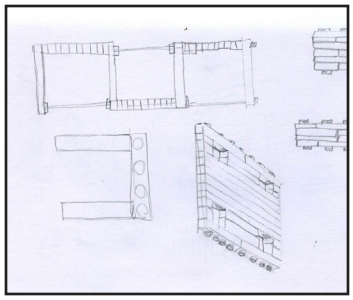


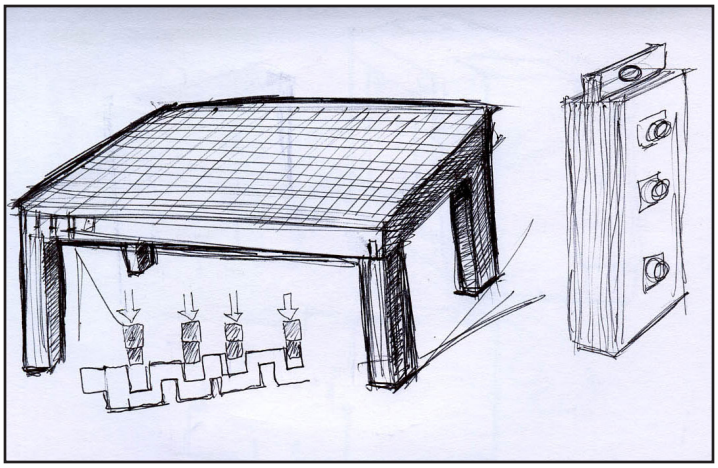


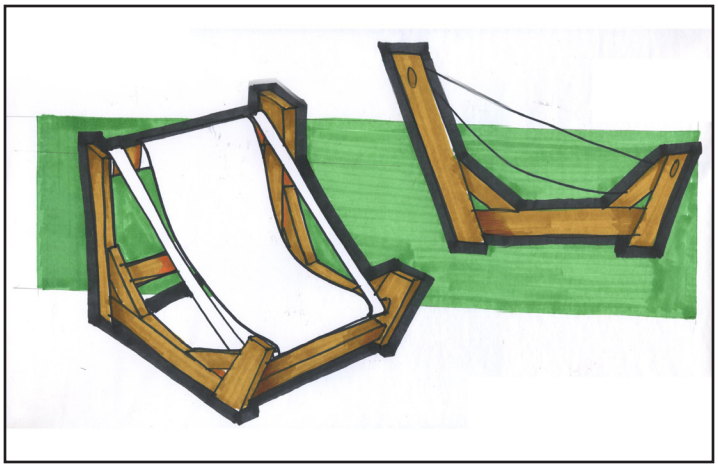


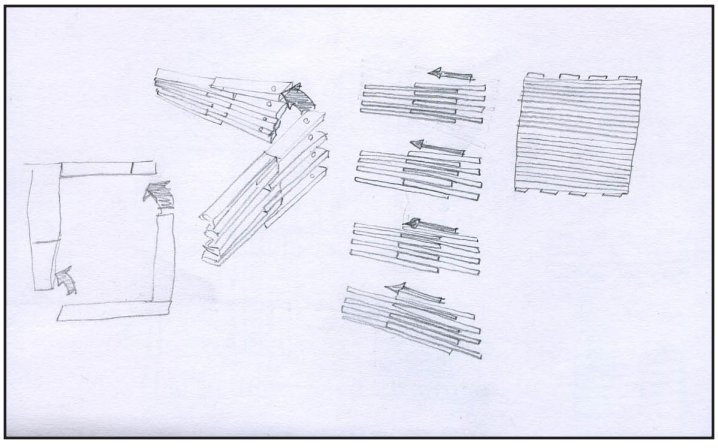




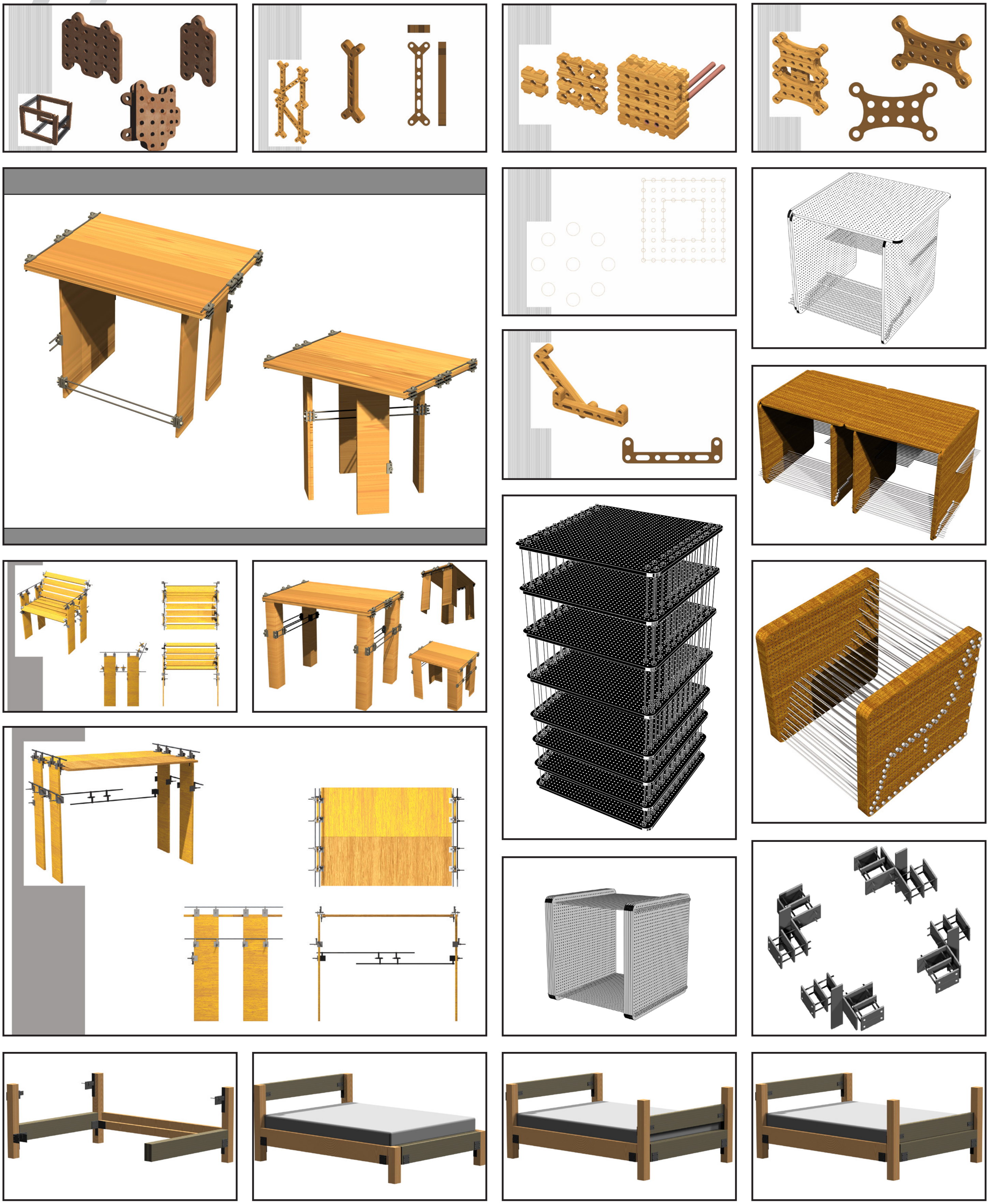








3.1 Modular Chair – “Physical” Sustainability ~ Idea



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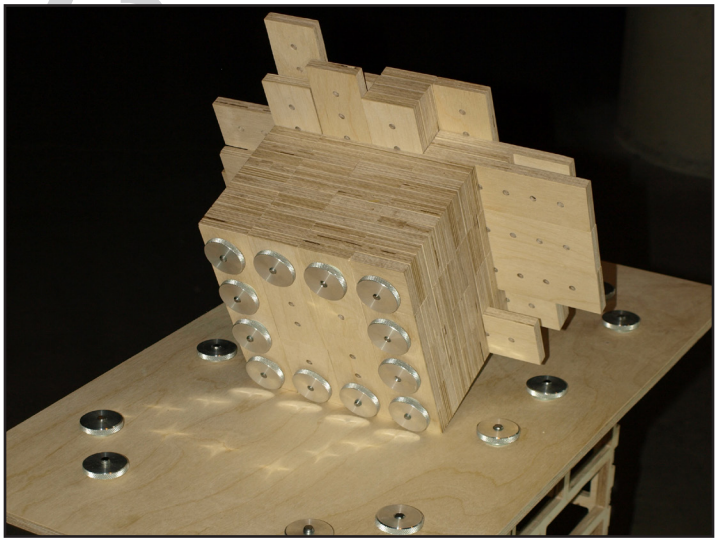
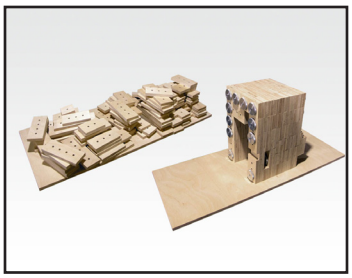
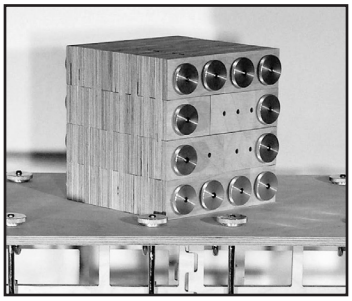
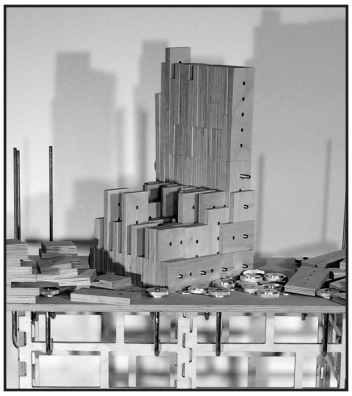
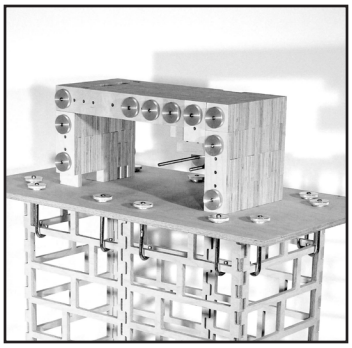
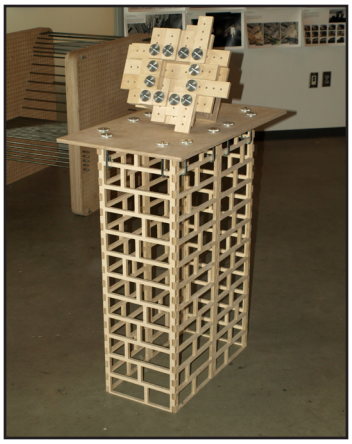


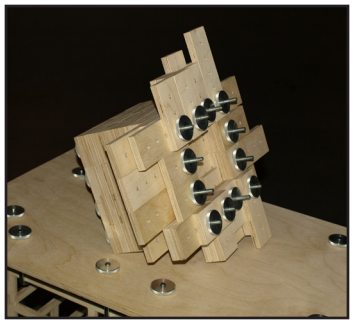


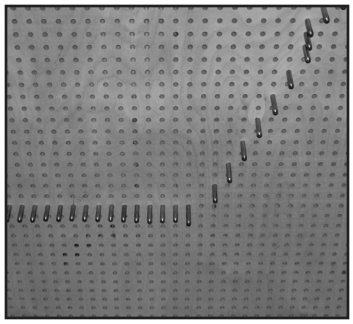


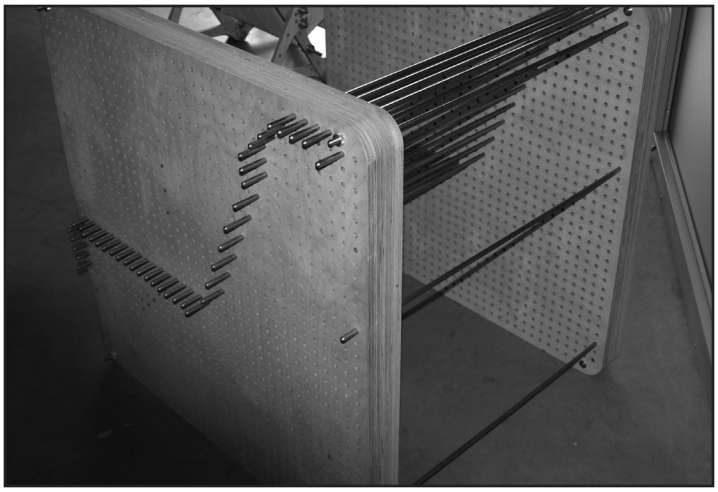


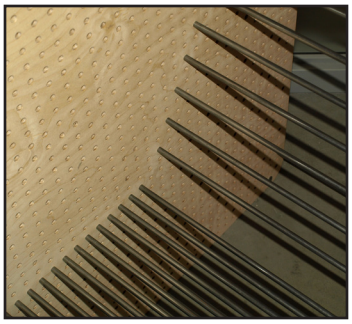




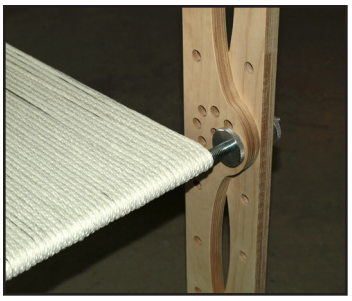


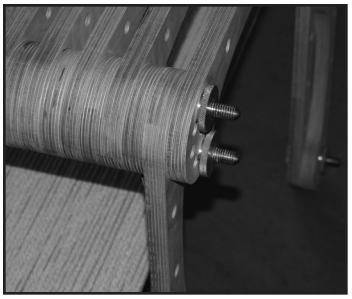


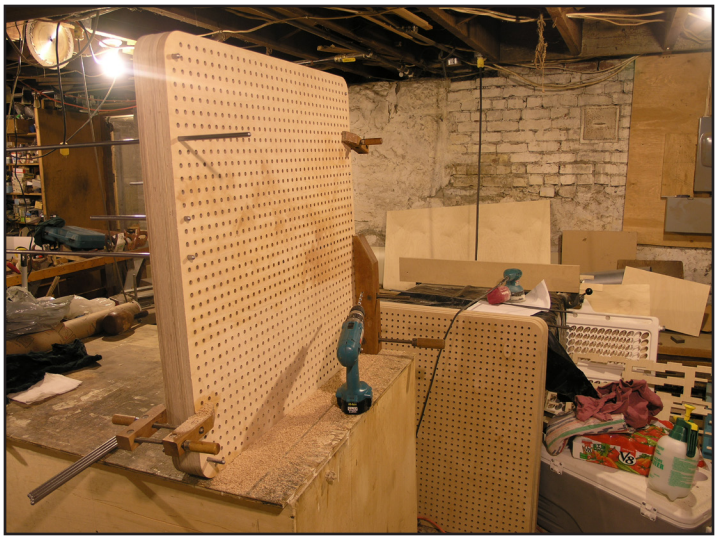


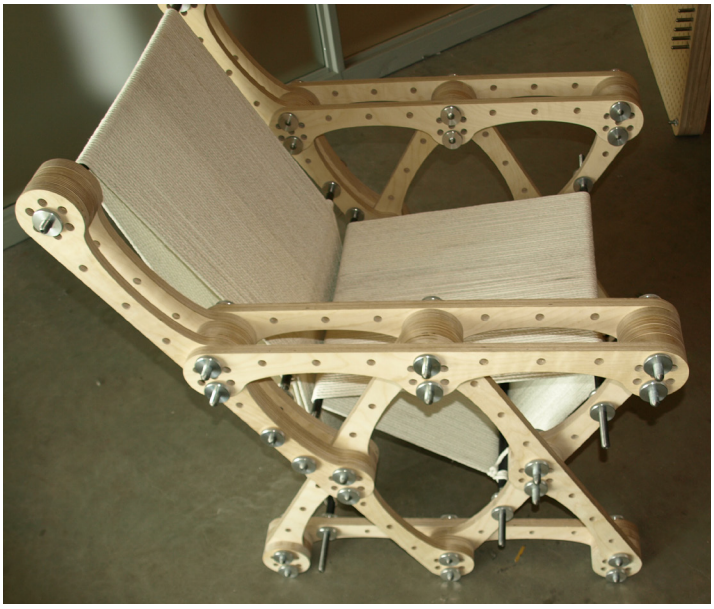


3.1 Modular Chair – "Physical" Sustainability ~ Production/Materiality









3.1 Modular Chair – "Physical" Sustainability ~ Final

3.2 Modular Chair – "Physical" Sustainability

Project Goal

The goal for this project was to explore physical sustainability through development of a system of modular furniture which can dynamically change from one form to another. It would be based on a series of simple rules and fasteners, but the final objects would be based entirely on the owner's evolving needs, rather than the need at the time of purchase.

Theoretical Framework

We must now start looking at how we design things not only from the standpoint of styling, function, and technological advancement but consider the complete lifecycle of the products we design.

There are a number of different applications of this type of thinking and, as with most types of practices, there is more than one approach to design. The primary focus of research for this project was Design for Disassembly (DFD).

Contrary to popular belief, these ideas are not new having existed for thousands of years in hundreds of cultures all over the world. Nomadic cultures have used this idea of modular objects as part of their daily lives for centuries. It allowed them disassemble their community and move it from harsh climates to more favourable ones and to follow animal herds on their migration routes without having to completely start over each time.

Another thing is that it is only recently, the last fifty years or so, where we have moved from a society where we repaired objects to extend their lifespan to one where we discard something once it is damaged, not necessarily even broken. The need to repair has been removed from common practice; discard and replace have been taken up in our collective conscious.

These types of methodologies are not completely gone from our society, they also exist within the current culture in the form of children's toys Fredrick Frobel's "gifts" would be the simplest version to Lego and Meccano, to name a few. Designers must be open to pulling inspiration from all areas of culture, society and age levels. Sometime we see things we miss by going back to the roots of an idea.

To be fair, there are a number of examples of objects which can be assembled, as well as disassembled, for reasons of transportation and storage. IKEA creates comparatively low cost furniture which packs mostly flat. The flaw in the IKEA approach, however, is that there is very little emphasis placed the ability to repeat the process, disassemble and re-assemble the products. This usually results in the end of the things you bought after one or two moves. These are the types of practices I wish to explore further.

Incremental adjustments to products and using design obsolescence as a practical business model has to be removed from our social and design vocabulary and practices. We need to consider how the lifecycle of our designs will exist throughout the product's life, primarily revaluating the notions of "cradle to grave" practices and looking to the more sustainable practices like "cradle to cradle". The goal of this experiment was to challenge this notion of single use as well as static form and function.

Skill/Knowledge

This project was broken down into three different designs; this section will focus on the final piece more than the others. As mentioned in my thesis statement in the introduction, this was the project I really wanted to focus, on looking to a modular solution to everyday furniture. This first project really helped to crystallize in my mind the importance of a number of key design ideas.

The first idea to be addressed within this project is that of process. Often there is an idea of the miraculous inspiration and the notion that designers have an epiphany and design comes out of the ether, as opposed to a process driven approach to design, where the designers follow a methodology of experiments, prototype evaluation and consideration.

This project was designed to follow this methodology. The first prototype was an eight inch modular cube (figs. 4,5). This was a proof of concept for the design theory that small units of various lengths could be combined and would allow for the ability to create different forms of "furniture". This first attempt was to establish a language of design and allow the participant to create their own structures using this system. The primary focus for this work was to see if you could develop and use a similar system such as Blocks, Lego and Meccano that would be capable of creating modular furniture by expanding on the notion of DFD. In Fabio Giudice, Guido La Rosa, Antonio Risitano's book Product Design for the Environment, they define disassembly as "the systematic removal of the required parts for an assembly, with the condition that the disassembly process does not cause any damage to the parts" (Giudice, et al., 2006). This was a key point to the design of the cube. All the parts could not interfere or harm any other part through its manipulation or transformation. This method of assembly takes into account the lifecycle of the object as well as the environment by designing the whole object in such a way that it can be easily be disassembled; it allows for the manipulation and modification as well as dismantling and recycling it once its useful life is over (Papanek, 1985).

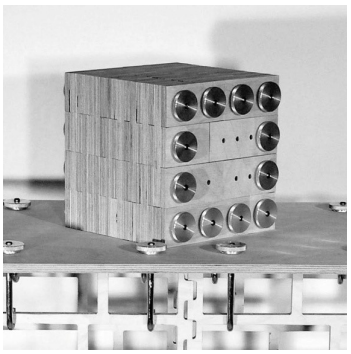


Figure 2 – Modular Cube

Although the object was a series of very simple shapes and was created out of only five different lengths of two inch material, the number of forms that one could create was almost endless. Although this proof of concept worked in showing that you could create various shapes and "furniture" type objects, it created a practical problem where the user had no limitations. This works fantastically for an experiment, but having limitless possibilities leaves too many options and transforms the object from a practical piece of furniture to a formless anything. While really embracing this idea of formless structures and considering that there are no right or wrong design solutions, the challenge becomes the capacity to create different objects easily, which this object fails at, purely because of the massive number of possibilities. Just keeping track of what users are doing became almost impossible.

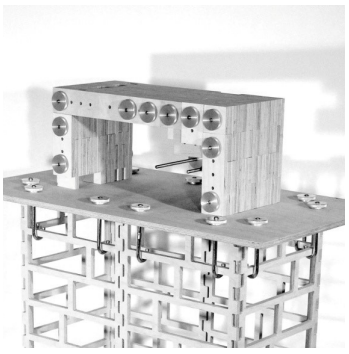


Figure 3 –
Modular Cube: Table

A secondary concern with this cube was the way in which the cube was held together. The long threaded steel rods were very useful when the material was compressed to the full length of the rod, but once you were only holding one or two pieces the amount of turning you had to do to close the gap on the screw made this method of attachment very labour intensive.

The primary concerns at this point were the need to simplify the objects' flexibility and to find a new method of fastening the materials together.

Next prototype of this project was an attempt to create a simpler system to create a piece of furniture a (figs. 6) The Green Imperative outlines the following steps to address challenges of "Design for the Environment" (DFE) (Papanek, 1995).

- It is crucial to keep the design simple by using as few materials as possible.
- Designers should incorporate as many additional functions as possible into a single part without compromising function. Also designers should try and create multiple or secondary uses for a product.
- Try and design objects to ensure easy recycling. This can be done by using DFD or just something as simple as material choices.
- Create truly modular designs. Modular structures should be preferred, whenever possible, because it will help with maintenance and repair and the longevity of the object.

All of these considerations are extremely important, especially within the context of these experiments.

The most surprising thing about this object was that in the form of a chair it functions very well ergonomically and was consequently comfortable to sit in. Unfortunately, that was the only really positive point with this experiment. The original concept of this piece was to create a piece of modular furniture which would allow the user to modify the appearance, function and ergonomics in order to best address the needs of the user. Although this created an object which was far simpler than the cube, this version proved to be the other extreme: the cube had limitless possibilities. Through this piece seemed to have very few possibilities. That the only thing you could change was the flow of the seat; the rest of the object remained fixed.

Figure 4 – Rod Chair

From these DFE principles, a number of things did not work very well with this experiment. Although the design was simple and structurally rational, there are a number of problems with the manipulation of the object itself. The weight was a principal problem for this chair and because of this it was almost impossible to move and to adjust its form. The metal bars have a tendency to bend as they are being pushed through the plywood, which in turn makes them extremely difficult to remove. Another flaw within this design is the way in which the metal bars are attached; the multiple holes did not create the desired variation. In fact the pattern was not flexible at all, allowing only for a very limited range of sizes and shapes. So these first two attempts at formless furniture ended up creating the two ends of modular systems scale where one had no boundaries and the other had too many. This is often how the application of design works, the project

shifting back and forth as you move closer to a design compromise which meets the criteria of the design brief.

The final prototype was the result of the positive and negative information learned while creating experiments one and two. The first two objects were successful, each in their own unique way. The first allowed insight into formless modular structure but was not practical as furniture. The Second allowed insight into a very narrow area of flexibility, in that sometimes a small change can create huge flexibility. The first two prototypes were successful in creating some significant insight into sustainable design practices, specifically within the domain of DFD. Weight factors, assembly and disassembly systems all helped to dictate the shape of the third experiment.

There are a few fundamental inspirations and ideas which need to be addressed to truly understand the purpose of this final project. This idea has been put forward by a number of designers. Buckminster Fuller calls it "less is more" (Morris, 2010), Ross Lovegrove calls it "organic essentialism" (Lovegrove, 2008), Louis Sullivan used "form following function" (Sullivan, 1896) and Papanek has his "the most with the least" (Papanek, 1995). All of these statements essentially mean the same thing and are at the heart of DFE and sustainable design practices. It is important to understand that this does not mean minimalism; far from it. What these designers mean is to create objects which fulfill the needs of the designer and user rather than the needs of the market, if they require a very complex structure; use them, but they do not use the simpler solution - use the best tool for the job.

The first thing to note is that all of the objects in (fig 7, 8) are created using the same wooden components, the only difference between the chair and the table are the metal fasteners and the amount of string being used. Limiting the shapes and materials used allows production to be simplified as well as minimising material waste. The material choices were made to allow for maximum recyclability and strength. The wood components were used for the larger outside structure for two reasons, the first being that FSC wood is a is a positive growth resource, and the second is that plywood is a commonly found building material which is becoming more and more efficiently manufactured and transported to urban areas.

Figure 5 – Modular table

These larger elements take up much less energy to create from wood than another material such as metal or plastic. The metal components are only used where necessary and serve as locking mechanisms and structural supports. Steel rods are used for the threaded portion of the fasteners so as to not wear by repeated dismantling. The final material choice was recycled aluminum for the knobs, because of the amount of material used and the number of knobs there was a need to find a strong material which would not wear or corrode, but also needed to be easily recycled because these would be the parts which were used the most and manipulated often.

Figure 6 – Modular Chair

This prototype was based on creating an object where as a user you could create much the same way you did as a child with Lego or Meccano (also known as erector sets) – a system which would allow individuals to create objects based on experimentation and interest. The success of this system is that the individual now has control over the shape and use of the objects they have bought and are no longer stuck with a "Thing" they need to throw out because it doesn't fit their new home or office.

One of the final thoughts about this piece was the notion of "product stewardship". This was an idea which was presented in Design and Environment by Helen and John Gertsakis. The idea is simple: designers or producers take back items to avoid landfills and keep valuable materials out of the garbage. They use the example of manufacturers such as Wilkhahn (Picto) who have put this into practice by developing ergonomic chairs with durability and recycling in mind. They look at their decision to design for disassembly as a positive for their company. They say it helps ensure that service and repair, end-of life remanufacture, and material recycling are not only realized but also add value to the overall enterprise because the producers stand behind their products. If this final experiment was ever to be produced, this model of product stewardship would definitely be put into practice. These types of modular systems allow for easy repair and allow the owners to explore new structures through disassembly of their old ones. After creating this final system to create two pieces of furniture as an exploration of its potential, it has become very evident to the designers involved that these two versions are only scratching the surface of what is possible with this type of structure.

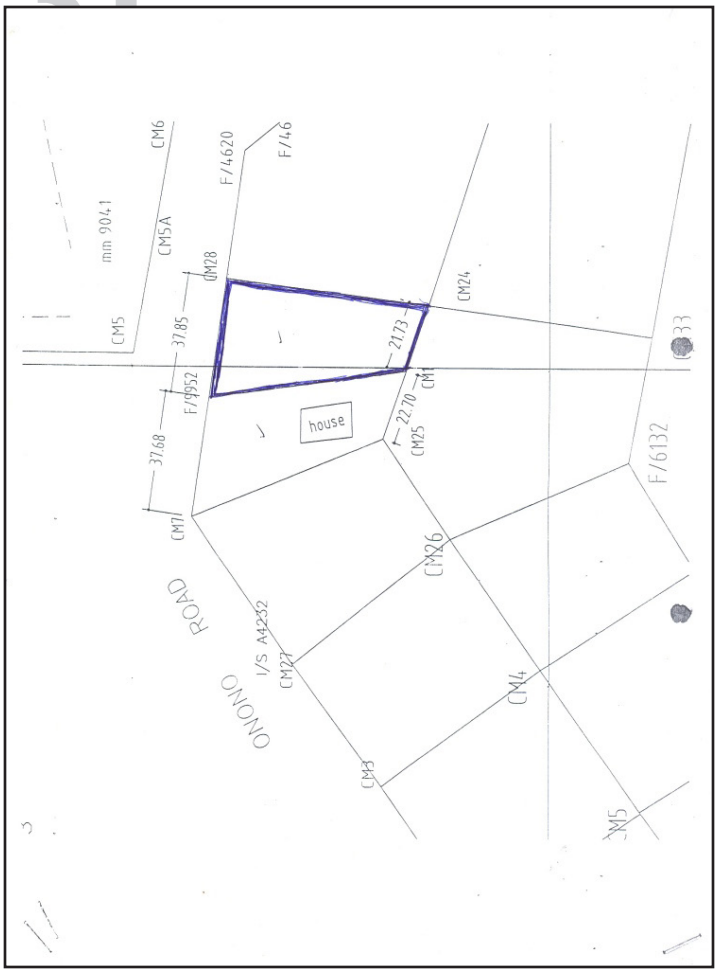
Project Conclusion

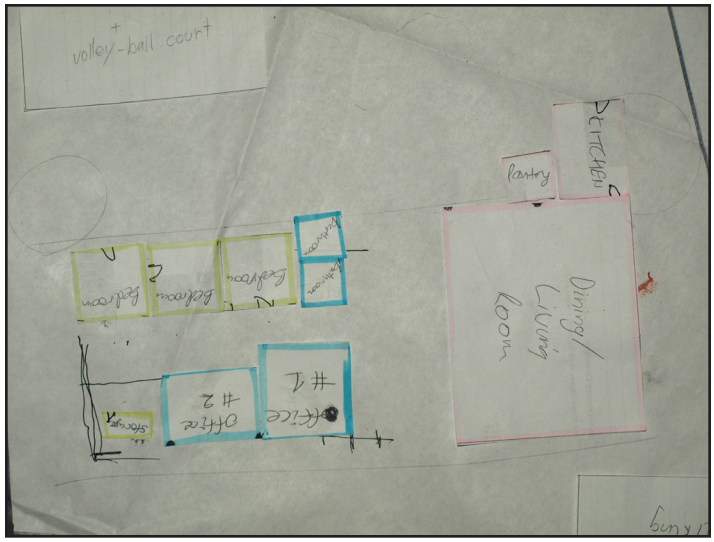
The first most important element of this project is the evolution of an idea, starting with a concept and following through to its logical conclusion. When we look at these three prototypes we look at an evolution of a thought, starting from a proof of concept through an attempt at application to a final idea. We see that design is best approached through the application of the creative process and not a one solution myth.

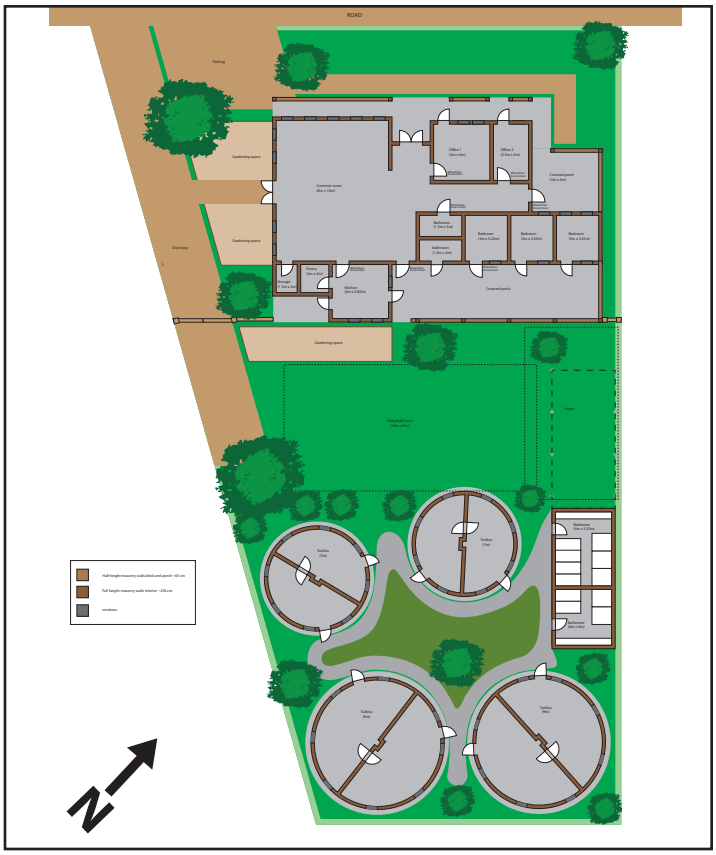
Although I learned a lot from this project and many things can be taken away from the process, the most important result is that that sustainable design does not need to be simple, it can be complicated and use new technology. These objects are by no means minimalistic, they are rational. This approach allows others to see the structure as well as the intention of these objects. After showing these experiments to others, the objects are instantly understandable, which allows users an insight into defetishizing our objects and their creation.

The object is to design a shape which inspires the imagination, promotes interest and will allow the user to explore their own ideas through play and personal experimentation. In the Green Imperative Papanek writes that it is the job of the designer to provide choices for people. These choices should be real and meaningful, allowing people to participate more fully in their own life decisions, and enabling them to communicate with designers and architects in finding solutions to their own problems even - whether they want to or not – to become their own designers. Designers always think it is their designs which will help to change the world, whether it through some type of material choice or through some super sleek new product, but the best way to change the world is to encourage others to participate in the process of change and this will encourage greener, more flexible, design

3.2 CVAP Building – "Social" Sustainability ~ Idea







3.2 CVAP Building – "Social" Sustainability ~ Production/Materiality

3.2 CVAP Building – "Social" Sustainability ~ Final

3.2 CVAP Building – "Social" Sustainability ~ Final


















3.3 CVAP Building – "Social" Sustainability

The second research project was focused on social sustainability; the goal was to integrate a design into a culture without damaging the existing social structure or imposing an outside set of values, use as much "local" manpower, materials, methodologies as possible, and design with the intent of having an ability to change, and be as flexible as needed.

Project Goal

Figure 7 – CVAP compound (Photo: PK Langshaw)

This project's mandate was to create a sustainable compound in Gulu, Uganda, a community that has seen violence and political upheaval for generations. The structure was to be designed as a place where the Concordia Volunteers Abroad Program (CVAP) could go and do outreach and other social intervention work.

Within the design brief, there were a number of concepts which had to be adhered to. The project was to be "sustainable". Within this context, sustainability was defined as that the project would eventually become autonomous, generate its own revenue and give back to the local community at large while becoming an example for future projects in the area.

Another requirement was that construction had to be local. This was because the non-governmental organizations (NGOs) who work in the area usually, if not always, contract their projects to international construction agencies. This consequently creates a colonial appearance in the architectural artefacts left behind. It also created an international style of construction which CVAP did not want. Their focus was on the local, something which does not appear to be out of place in Gulu, neutral, and something which the society as a whole will see as part of their community.

The final goal for this project was to take on a collaborative approach. There were engineers, artist, project managers, and local community members. Design is very rarely a solitary practice, this project was no exception. The best projects take from multiples sources of information and synthesize that information into something which would be very difficult for one individual to develop on their own. Contrary to popular belief the more people involved in a project when managed correctly creates a multiplication of intelligence and ideas not a division. Because of the complexity of this project there was a need to engage as many people as possible to create the best possible results.

Theoretical Framework

There are three major ideas that were addressed within this project, first, the notion of sustainable construction; and second the concept of social sustainability; and last, the idea of cultural sustainability and slow design.

During the implementation phase of this project there was not a lot of time to do the due diligence of Life Cycle Assessment, Natural Step or any real rigorous analysis of materials,

processes or cultural effects before we began. This project was about setting up a dynamic system that would be able to adjust, not just building something and seeing what happens. The intention was to start and directly adjust and move forward, allowing the project come into its own through use; the key to success would be the ability to be flexible in its implementation as well as operation.

In Sustainable Design towards a New Ethic in Architecture and Town Planning the author writes that "architecture gives people the possibility of empowerment to define who they are to develop consciously and independently" (Contal, 2009). This was what this project was, a site was designed to help and empower, not just a place to live. By always looking at the community at large and working back to a building, rather than just building something, we planned and included the society as a whole.

Cultural sustainability is as important as environmental sustainability. "The culture of a place is also inseparable from the natural environment and it certainly has a role to play in the pursuit of environmental sustainability of a place" (Chiu, 2006). With the norm being a colonial approach to the architecture, in Gulu there was a mandate to implement a sustainable building without neglecting the culture as well as the character of the culture we would be influencing. "Cultures should flourish and be enriched, alongside with social and economic advancements" (Chiu, 2006) not be crushed by it.

"Both the cultural and social dimensions of a society have strong influence on and are indeed partially composed of the value, norms, customs, social structure and life style of a community" (Chiu, 68). This structure was an attempt to understand these values, not by imposing, but collaborating, allowed an insight into ways we can work and succeed in outreach by working with society at large, to create something familiar rather than colonial and foreign.

In addition, the idea of "slow design" was key. It is said that slow design reveals experiences in everyday life that are often missed or forgotten, including the materials and processes that can be easily overlooked in an artifact's existence or creation. (Strauss, 2006) This type of approach is critical within the sustainable design movement. This project has cultural implications on a local and national level, as well as an understanding that this site will not be finished for years to come but that is okay. As people come and go from the site it will be up to them to modify the site to suit the needs of the time.

This approach, used from the beginning, sets the stage for a diverse exchange of information, energy usage, building plans and concept drawings, potential uses for the building, and all the way from how food would be prepared to where the act would take place. It allows the building to become a living thing, not just something to reside in, but something that functions beyond how you might ordinarily think it should.

Skill/Knowledge

The development of this project revolved around a number of different scales of research and meetings. The first few smaller meetings were simple, a perfect example how designers often

have to begin projects with little information and fill in the missing information with best practices and personal experience. Information came piecemeal. In hindsight, as with many large scale design projects, there should have been more concern regarding the scope of the project; but if there had been, this project would never have gotten started, let alone finished on time.

This project was created using a multidisciplinary approach as to how we would work. It was refreshing to see so many people present: engineers, designers, artists and administrators. Often we hear about ideals of ecological design and how to implement them. For instance, David Orr defines it as: "ecological design: a large concept that joins science and the practical arts with politics and economics" (Orr, 2002).

The largest decision with the compound was that it had to be as close to self-sustaining as possible. The agreed upon idea was to create a solar system with photovoltaic cells to generate power. The power consumption was also to be reduced, but in an intelligent way, such as moving from desktop computers to laptops, as well as motion sensitive security lights that would not be on 24/7. The goal here was primarily the stability and safety of international visitors due to the unstable nature of the Gulu power grid. However, an equally important reason for self sustaining power was to create a safe place in the community in case of emergency, with the long lasting goal of mitigating the use of the already fragile power grid.

The second process discussed and to be implemented was the rainwater harvesting system. This system was to be used in the same way as the solar power system, to limit the overall impact of the building and compound on the local community. It could also be used to help create and sustain the compound's many gardens which have the added benefit of generating food and making inviting surroundings for people to enjoy. At the very minimum, the compound would be a neutral consumption influence on the Gulu resources, with the long term goal of being a positive influence and giving back. Although that objective may be a few years down the road, all decisions were made to that end from the project's inception.

There were a number of other ideas brought to the table, such as composting as well as alternative cooking fuels, but these were tabled to be used at a later date as they were not feasible at this early point of the project and budget. All were noted, however, and could be implemented in the future. Many decisions were made based on results being needed, and deadlines approaching.

The only way these kinds of large scale international projects can be accomplished is through an enthusiastic group of people willing to put in the time and not just leave it once completed. People are not looked at as talent but as stakeholders. In Engineering for a Finite Planet: Sustainable Solutions it is written that "to generate this kind of work, there must be a creative relationship between members of the design team. Such matters are always difficult to analyze, not the least is because relationships vary from job to job" (Davey, 2009). If their expertise is needed in the future, or their original approach needs to be adjusted, it's not looked at as a project but as a mandate to help.

One of the most interesting things to come from this project is the simple realization of the cultural baggage we bring to a design. Although this is not necessarily a detriment, what we bring with us needs to be understood.

In North America, geometry is often used for scale, proportions, and patterns. We don't realize that we are surrounded by the shapes of Euclid – circles, rectangles and triangles, etc. The interesting thing is that the continent of Africa uses a different kind of mathematics. In Fractals, Complexity, and Connectivity in Africa the authors point out the difference between the North American culture and African. "For example, much of New York City is laid out as a grid, which may be seen as a collection of rectangles. It also includes an ordinal dimension in that streets can be numbered. For the inhabitants of a built environment, the very obviousness of certain patterns can make them invisible because we don't have built fractal structures to contrast them with. As we will see, fractal geometry not only illuminates the underlying structure of African designs, but also helps us see the cultural-boundedness of our own mathematical practice." (Ron Eglash, 2005).

These concepts are equally important to the way we should approach the problem of designing in Gulu. I never would have thought of the grid and its application as a western artefact. We need to remove our preconceptions about what we think we know when working on projects such as these and realize that we do not always know best, again referring back to cultural sustainability.

Project Success

By using local workers and construction practices, the building was better integrated into the community and not something built by outsiders, for outsiders. Now it would become something for the community, by the community, rather than a building with no cultural reference point. This site will be used by locals for meetings and other outreach beyond that of the CVAP group.

As designers, we really need to look at the larger picture and think long term about what we do, and also to think and be flexible with what we do, not only when dealing with international and sustainable development but throughout our design practices. Only through learning, experience and collaboration, will we be able to work sustainably and long term.

An example of this kind of thinking is when we look at some of the work of Bill McDonough and associates in China. McDonough is often heard saying that "Design is a signal of intentions…" (McDonough, 2002). The problem is to make sure that your experiences and intentions are pertinent to the culture and audience and not colonialism. Take the Huangbaiyu village for example, a sustainable village project created by William McDonough + Partners. In this project we see the pitfalls of this type of thinking, where context is neglected for a perceived "better" understanding of "West knows best".

This project was supposed to be the creation of a completely eco, cradle-to-cradle village in China. People have been very critical of this project, but I think it is a good cautionary tale for our project and on larger scale design practice in general. The reason is that it is obvious that

the context of location and what these villages needed was omitted in lieu of "progress". As A.K. Streeter writes, "McDonough's Master Plan for the Huangbaiyu village was ambitious, and the housing was supposed to be a model of 'Cradle-to-Cradle' innovations. Two model homes would show off systems that handled 'biological nutrients' and 'technical nutrients' 40 further homes would showcase integrated potable and grey water community systems, and a biomass gasification facility for homes' heating and cooking. And that was just Phase 1!" (Streeter, 2009).

Although there were grand designs for McDonough's project, the project fell apart because of the context and what the people needed within the culture was lost. This entire development was a top down design approach and had very little to do with the actual needs or wants of the individuals involved. While reading this article I was struck by something written in The Design Experience the Role of Design and Designers in the Twenty-First Century, that said, "Designers create culture, create experiences and meaning." (Press, 2003). But obviously as Streeter continues, "Now the shells of the Huangbaiyu houses sit empty, and McDonough has moved on." (Streeter, 2009). Designers can also kill culture, experiences and meaning with the same kind of ease.

The tragedy of Huangbaiyu village project is that McDonough and Associates have moved on. Designers need to realize that it is often very difficult to be critical of a project as you are working on it, but it is essential that there is a dialogue once it is complete. The element of time becomes very important to see how a project will come into its own. Fresh eyes or a break can be important to the success of a project, as well as the long-term sustainability of that project or slow design principles. Further, flexibility is key to how something will function. Saying this is how it will be, and leaving, is as useful as predicting the weather two years from now.

As designers, we often see projects as finite. Our interventions are often contractual or only needed in the initial stages of the project and rarely do they allow for long term evaluation. This is inherent in the design process as Nigel Cross points out in Designerly Ways of Knowing that, "the designer is constrained to produce a practical result within a specific time limit, whereas the scientist and scholar are both able and often require, to suspend their judgments and decisions until more is known- 'further research is needed' is always a justifiable conclusion for them." (Cross, 2007).

This can be seen as a double-edged sword; we always have to get the project done within the given time frame, but in getting the project done, what if you miss something on the way? Looking back on a project is often regarded at as a secondary thought within the practice, but also what about tweaking and changing as we go, rather than saying, "it was the best I could do at the time" (Cross, 2007)? This kind of thinking often precludes the idea of sustainability, or at the very best means that you must consider all avenues during the implementation portion of the project and there is always an excuse for why something failed. Your options are therefore always a complete success or a complete failure. We should approach projects with the mentality that they are iterations of a larger project. In other words, "it was the best we could do at the time but I think we should do this now because it will make it much better". This is the approach taken with the CVAP compound.

The Huangbaiyu example is a cautionary tale that helps us realize that we really needed to think about what we were doing, not only in the act of creating a building, but that we are creating something for a community, something which could help in a positive way. But one must always be aware that projects must be flexible. The more inflexible, the less likely they are to succeed. As with the mandate to the CVAP compound they must continue to evaluate and adapt as problems arise.

Project Conclusions

Design is about creating. Sustainable design is about understanding that the things you build exist within cultures and societies and the less flexible they are, the more likely they are to be discarded physically or emotionally. Design needs to address space and place, as much as materials and style. By omitting culture, society, and people, you inevitably create an unsustainable system.

There are a number of important things to discuss with this project. Although I have criticized the fact that I feel a disconnect with this project this is normal with design. This is a normal and very familiar feeling with designers. The reality is Designers are rarely involved throughout a project, much like I was in this one. It can be hard to deal with because as mentioned designers by their very nature like to be in control. But again this release can be a very freeing and also very rewarding at the same time.

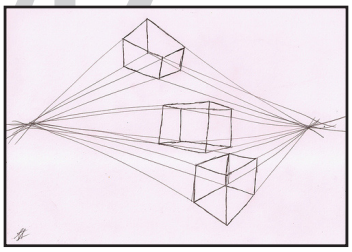
As designers we are asked for Ideas and solutions during the creation of a project, this is where we thrive. We are creative idea generators, and those ideas are then used by others to help generate physical objects, systems, etc. seeing these ideas gestate in others and their interpretations can be wonderful. In the end this project is about was about experiential learning and has been a very different experience for me. The intension of the site was to allow others a place where they can do outreach and engage in a meaningful way with another culture. By others.

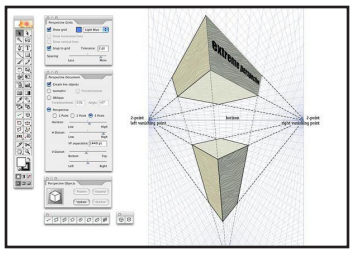
This project has started a dialogue about the potential benefits of student outreach within a global context and the building of a place where that could be done in a safe and engaging way. What has happened is way beyond our initial dreams in that the overall goal of the project has continued to grow and evolve. As with any great sustainable project the goal line is being moved, constant evaluation of ways to reduce impacts are being taken, solar panels added, computers replaces with low power alternatives, trucks being swapped out for smaller motorcycles and bikes. This project was to create a place where students can go and work on outreach; the long-term benefits of this project are only beginning to be seen. CVAP has been awarded a number of prizes including "J.W. McConnell Family Foundation Community Service Learning Award, 2013" for their work on this project and other outreach which they were responsible for in Gulu, all of which is to go to Sustainability purposes in Gulu and Montreal.

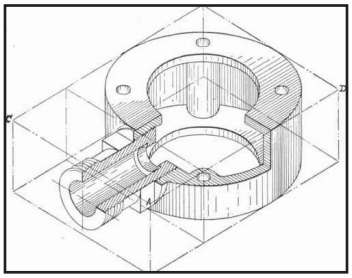
This project has been about starting something and letting it loose into the world where sustainability was at its core. Although we have not created an ultra sustainable complex, we have created something which needs to be recognized as a step in the right direction with the

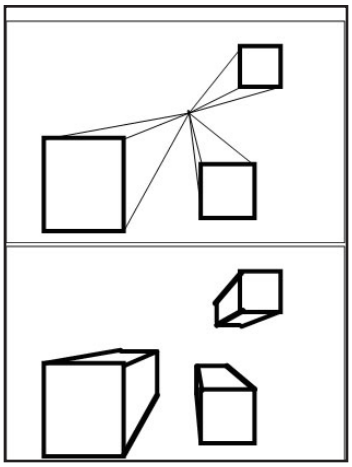
long-term ambition that we will get there in the end. As Daniel Lavigueur said "Our mission is being recognized, It's validation [means] we're on the right track." (Duval, 2013). From the designers perspective I think this project has become a great success because it has become more than the sum of it's parts. It has become a great example of collaborative design practice where designer and engineers respected each other and the overall goal of the project was realized, and continues to trive in ways which were nevr possible to realize when the project began.

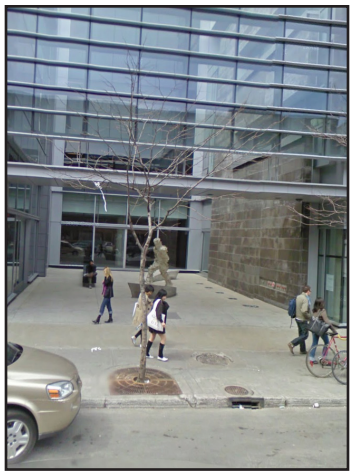
3.3 FOFA Wall – "Local" Sustainability ~ Idea

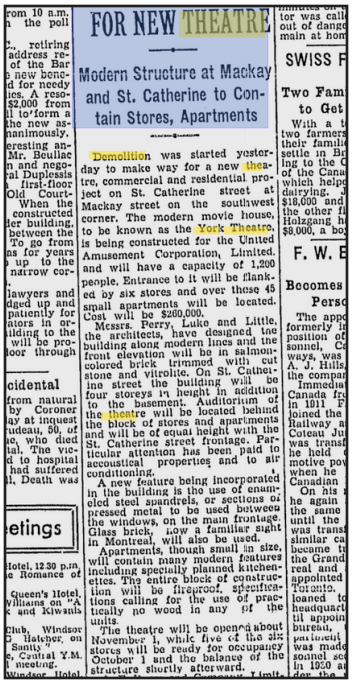


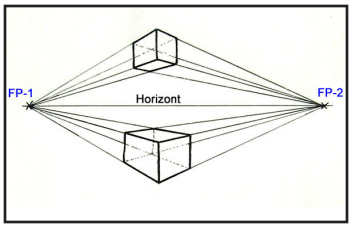


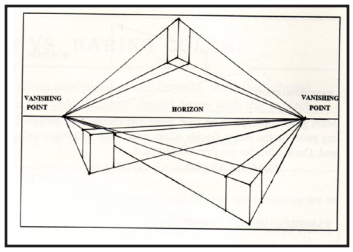


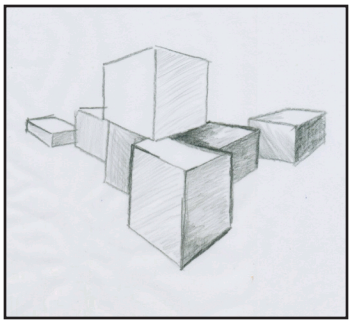


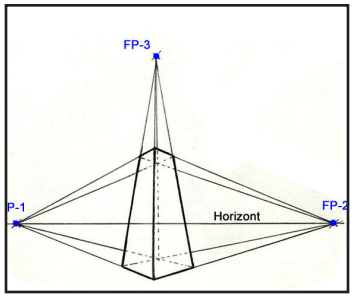


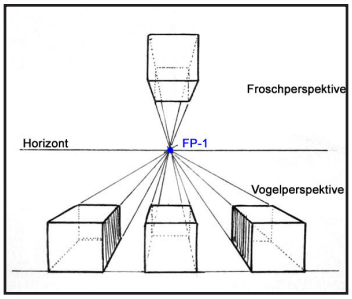


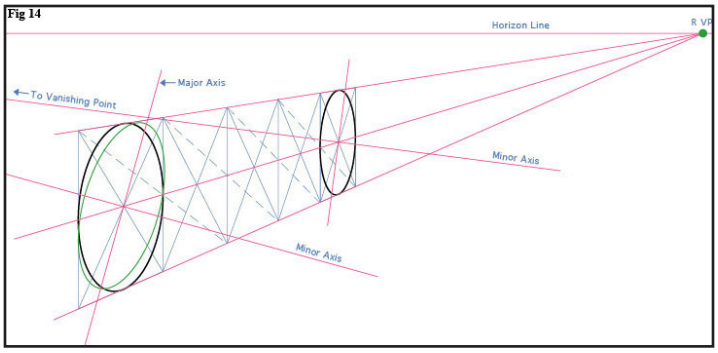




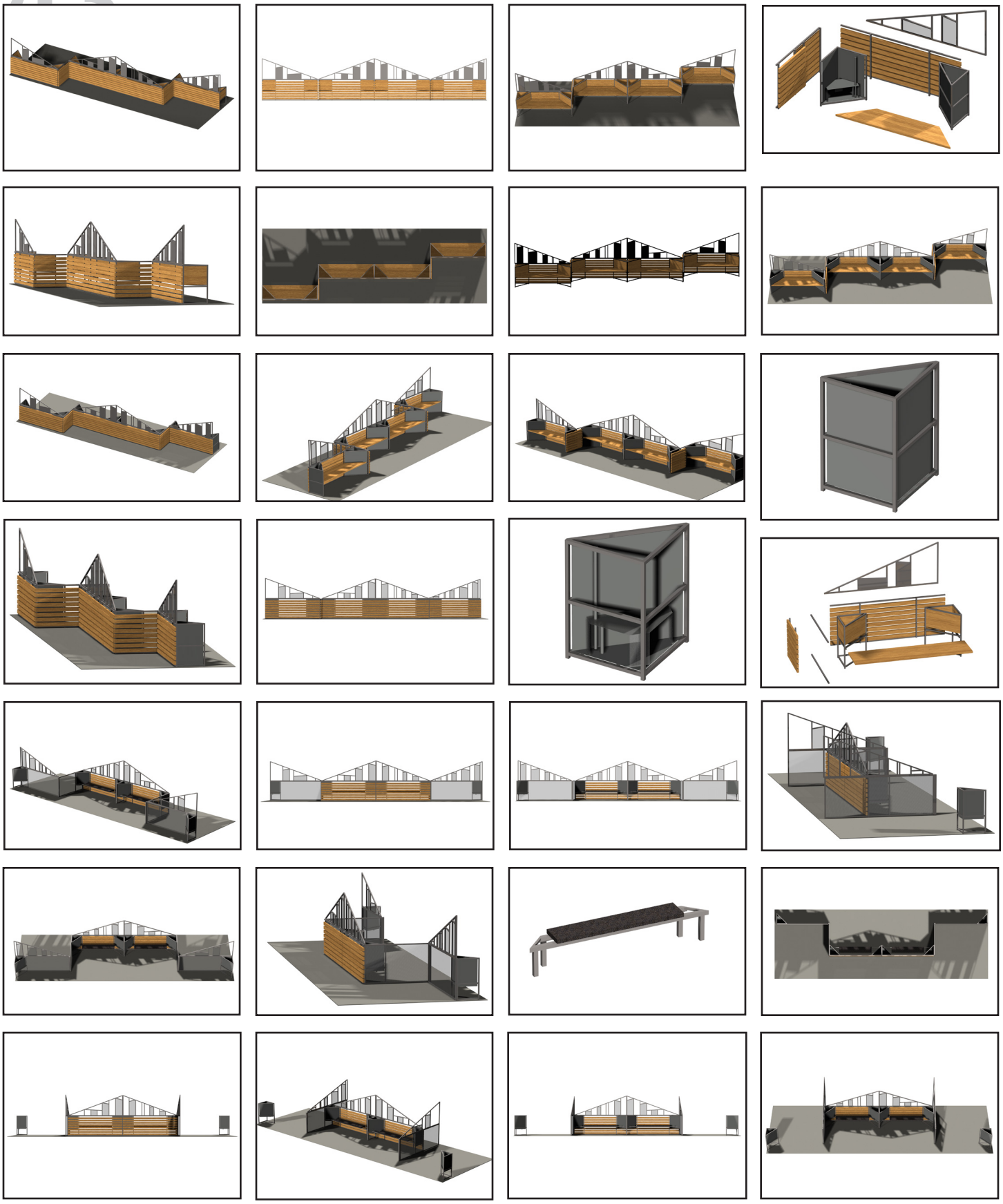




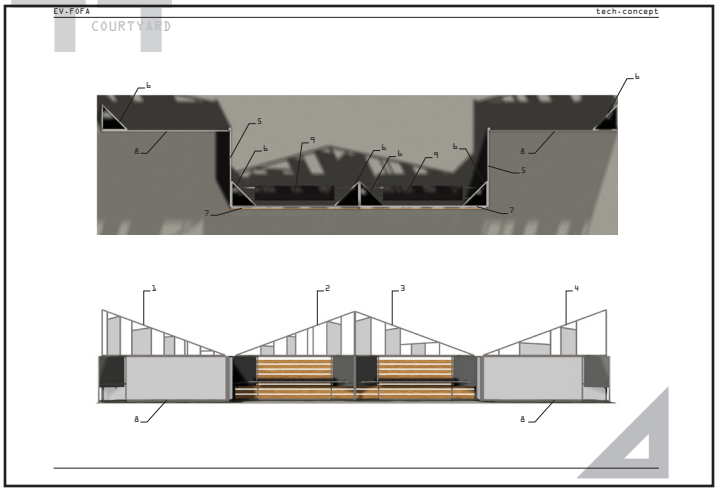


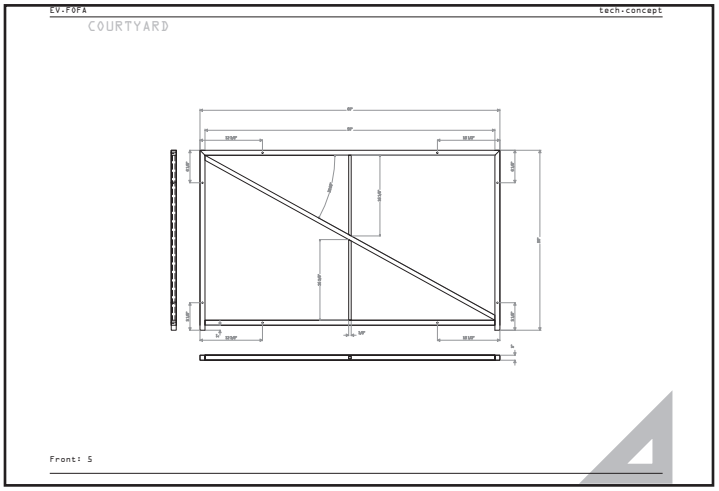


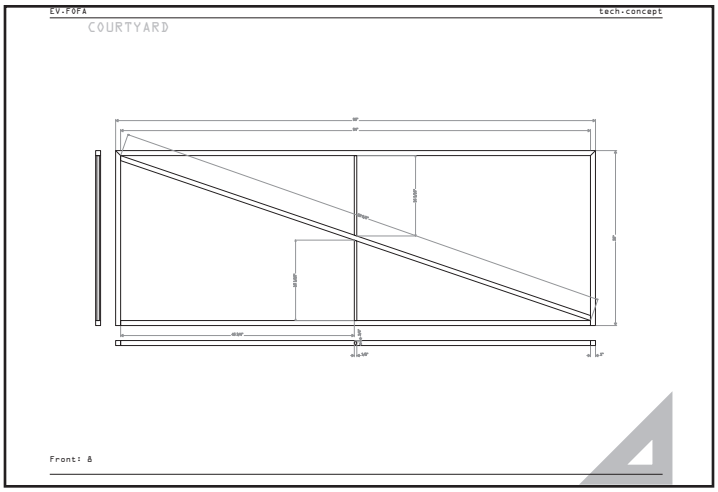
3.3 FOFA Wall – "Local" Sustainability ~ Process

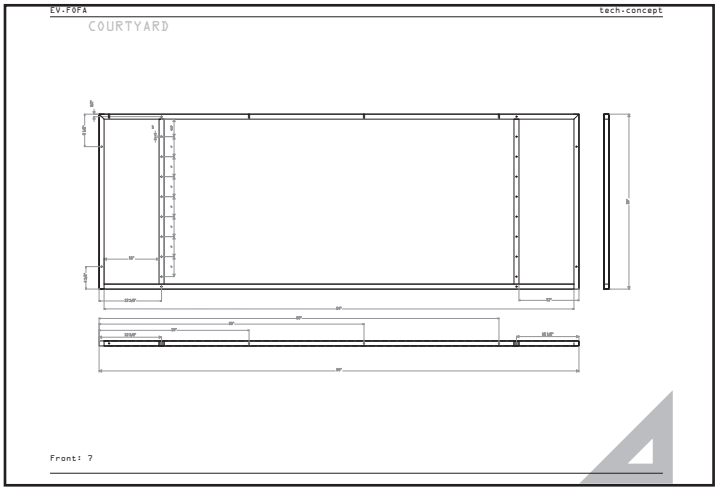


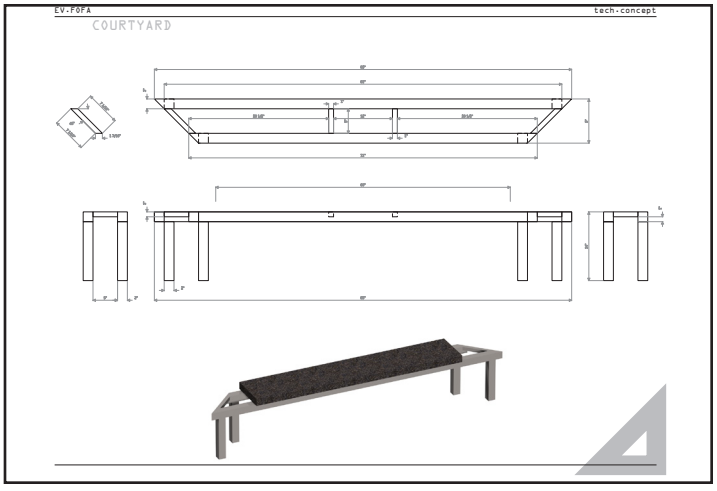
3.3 FOFA Wall – "Local" Sustainability ~ Production/Materiality

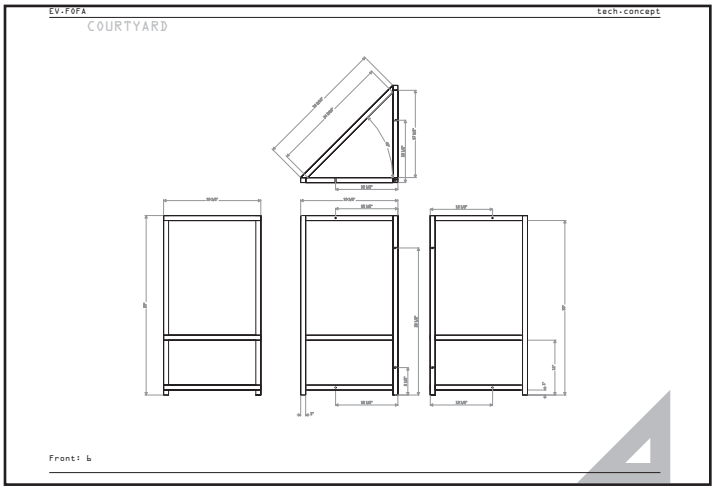




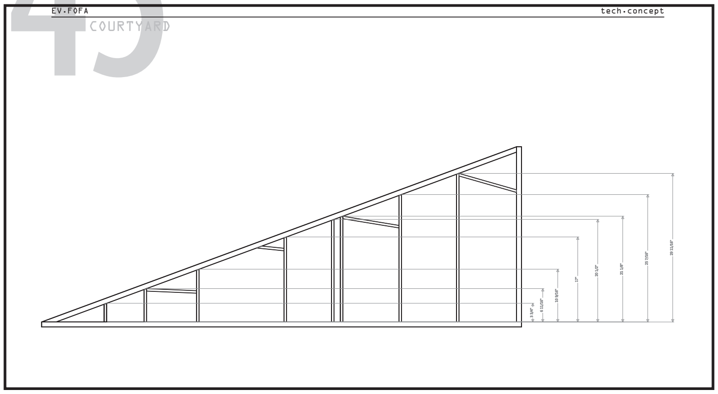


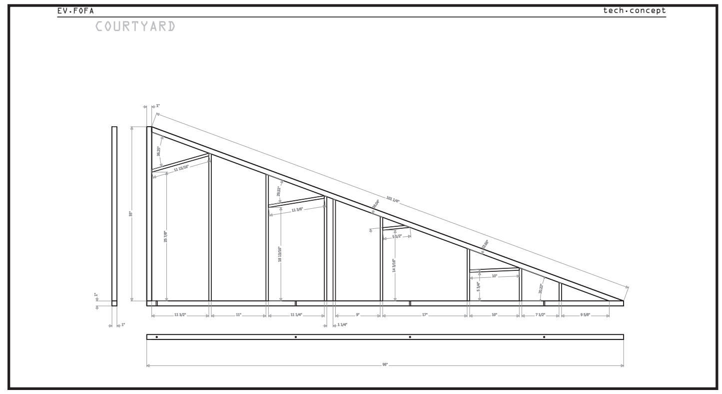


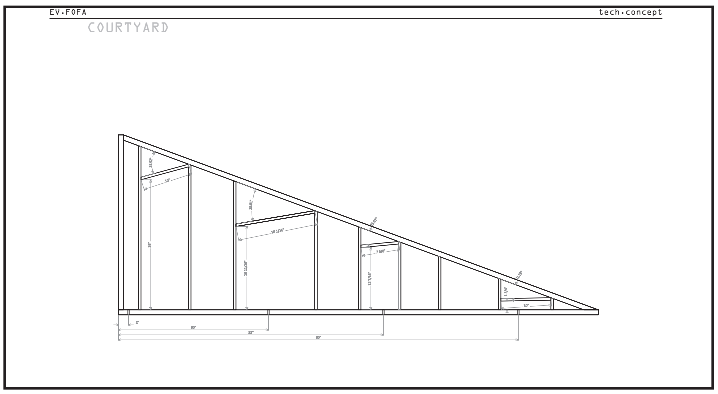


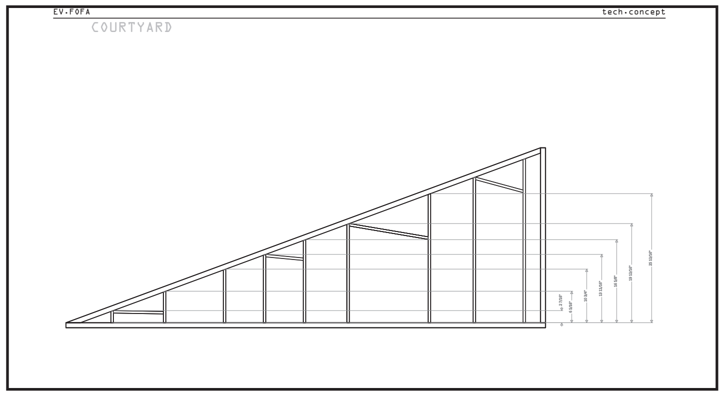


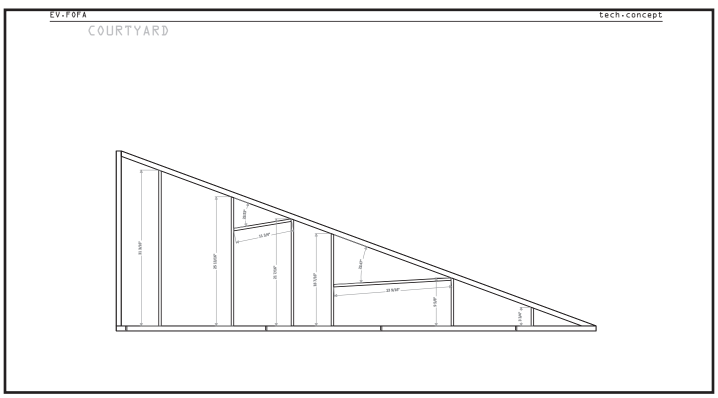
3.3 FOFA Wall – "Local" Sustainability ~ Production/Materiality

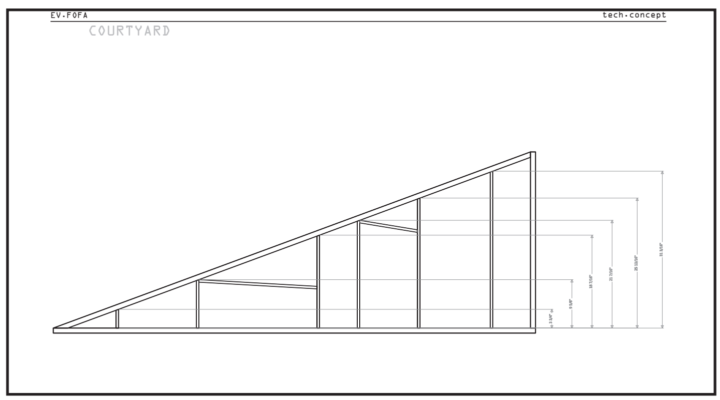


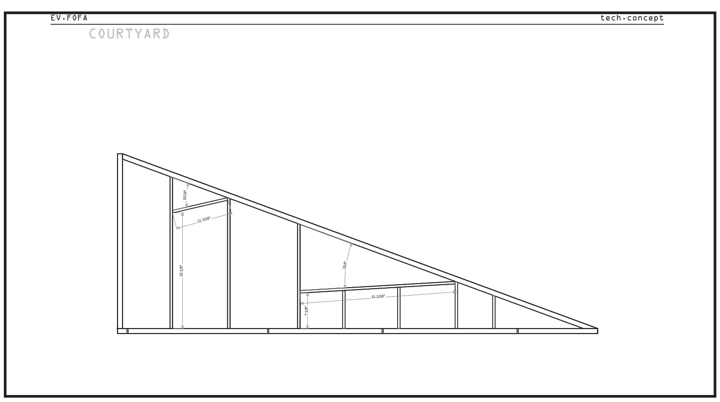


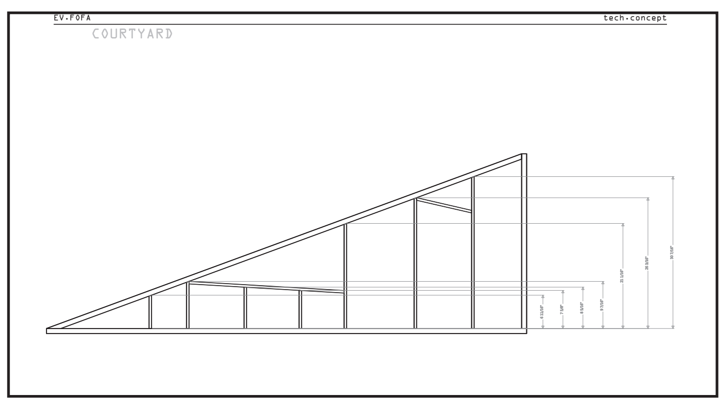












3.3 FOFA Wall – "Local" Sustainability ~ Final

3.4 FOFA Wall – "Local" Sustainability

If design is about turning concepts into reality, there needs to be an exploration into how design exists in society. One of the more interesting examples of product assessment is the "Cradle to Cradle" (C2C) methodology. C2C is about looking at the cycle of the product, not only from the standpoint of its creation, but also looking at how that production will affect the recyclability and whether it can be returned to its original materials. By taking into account the long term effects of our designs, we can be more careful about how we produce, what we use to produce, as well as even the simpler question of whether or not we should produce new items (McDonough, 2002). This project was created with this methodology in mind.

Project Goal

When one thinks about sustainable design, one usually thinks of smaller things which are more disposable, sometimes furniture or buildings, but rarely one would think of a fence for a coffee shop at an academic conference. The brief for this project was to define a space. The existing location was an open air dead zone on campus which needed to be transformed into a enclosed space. The mandate was this had to be sustainable as well as removable. This project differs greatly from the others in that it was a self-directed project where the design implementation, construction were all done by one person, with only minor oversight from a finance committee. Not to say there was none oversight came from input by others to make sure the project stayed on track, and met safety concerns rather than implementation, look and feel.

The mandate for this project was to construct of a 33 foot wall which would be used to create a security feature for a conference cafe. It had to be modular and moveable, it needed to have two large doors which could easily open in case of emergency, have green features with living plants and water systems and finally needed to be able to fit in the back of a 4' x 8' pickup truck bed when broken down.

Figure 8 –
FOFA Wall: Interior view

The reason this project is relevant for discussion is that it is an honest attempt at a sustainable design project. For me this project really exemplified the contemporary design process, as well as being a real life example of design, clients and design process. Typically Client based projects end up with the best case or best intension of being "less bad" for the environment because usually the time constraints and budget hinder the more effective sustainable design practices. In this case the client and designers were both eager to make a sustainable design statement, which was that sustainable design can be just as effective and interesting to that of high-end non sustainable work.

Figure 9 –
FOFA Wall: Street view

Often it is difficult as a designer to jump into these types of projects because they require quick turnarounds and are usually poorly defined concepts. Typically, this results in off-the-shelf supplies materials and methods rather than considered ecological approaches. This was going to be built from the ground up, keeping all materials pure, such as steel and cedar wood paneling rather than some hybrid of plastics. Welding was used as needed and non-permanent mechanical fasteners were used where one material connected with another to facilitate recycling.

Theoretical Framework

Designers often work in areas which are comfortable, this is why furniture makers work with chairs, and web designers work online. A key element to this project was to understand that we need to start all projects where designers are, and to use that point as a beginning. In Upcycling they talk about this idea as "to start where the designers are, in real life. And we can do this piece by piece, day by day (McDonough, 2013)." But the overall goal is to try and design more sustainably.

David Pye calls it the idea of "workmanship of risk" versus the "workmanship of certainty" (Pye, 1968). Often designers will look at a problem and move in familiar directions using processes as well as methods which they have used before. The problem is that up until recently we have not had the opportunity to work with a sustainable mind. These are new innovations; we need to look at what we are doing and move outside of our comfort zones and into areas where there are no certainties.

This becomes critical within the practice of design because as designers, we are asked to create objects on a very tight deadline, with no money and we just have to "figure it out". The reality is that the majority of the work to be done by designers is last minute. There is always a time constraint for execution. It's a common thought that "the designer is constrained to produce a practical result within a specific time limit" (Cross, 2007). This can be hugely problematic especially because sustainable design practices require so much forethought.

The importance of how we introduce these concepts early becomes clear when doing projects like this, because designers will often revert to what they know and can do quickly, and cut corners. Therefore, it's important to embed this knowledge early on in the design education process so that the default approach is sustainable and not the alternative, with the goal being to plant the idea of sustainability into daily design operations of drawing, sketching, or computer rendering; sustainability is just part of the practice.

My objective for this project was to "strive to be 'more good', and not 'less bad'." (McDonough, 2013). In Cradle to Cradle, the concept of how we should design is approached in a very utopian way. We should approach every project with the idea that doing "less bad" isn't good enough. But as we have discussed, it is sometimes better to start something, rather than saying that it is impossible and never attempting it. The majority of sustainable design practice at the moment is about opening a discussion on how we can be better.

The overall goal of this project was to spark discussion to help people understand that by action you can create change. This is addressed in the book Upcycling; "of course, not every material and technology solution employed… is perfect, but we are working toward the goal, inspired by a whole host of manufacturers-and the architects themselves." (McDonough, 2013). We wanted to create awareness about sustainable design, as well as create something that would endure until it was no longer needed. This is a key distinction as it was not designed to be thrown away, it was designed to be recycled and to be moved not only when it was broken because of poor workmanship, but rather when it was no longer needed.

Sometimes designing a thing which is unique and especially suited for a singular purpose is as useful as creating a system that can be used in a hundred different ways. Donald Norman discusses this tension between satisfying our needs by purchasing a readymade object versus making one ourselves. He further goes on to talk about the fact that most of the time we are unable to build the objects we need, for we lack the tools and expertise, to say nothing about time. In the case of this project, the building was part of the project. It was an attempt to address the issue and create something without knowing or having the skills at onset, but to start learning those skills as work was being done. Learning was part of the design process.

Norman goes on "when we buy someone else's objects seldom does it fit our precise requirements." (Norman, 2004)It is impossible to build a mass produced item that fits every individual or site precisely. And he points out that there are five ways to deal with the fact that nothing is designed EXACTLY like what a person would need: live with it, customize it, customise the mass production, design our own products or modify purchased products (Norman, 2004). But the reality is that the vast majority of these objects create waste when something "better" comes along.

Sustainable design needs to address these issues as, with anything, everything is finite. And if we embrace this at the inception of a project, we will have a much more successful result or at the very least a much easier time disposing of it after it's no longer needed.

Skill/Knowledge

This was a strange project because one of my goals was to do it. Often we look at design as a means to an end, and not something to do, or something to try. This was one of the key points to this project for me, to learn to do something different.

The realization of why one designs became very clear to me while working on this project. There is an adage that all humans are designers. "We manipulate the environment to better serve our needs. We select what items to own, which to have around us" (Norman, 2004). This is not true as there is more to being a designer than just manipulating our environments; it is the interest and will to do it as well. Designers need to change their environment, change their skills or just try new things. Everyone is not a designer, but everyone has the potential to be one.

Project Success

This project was a success, by virtue of it being completed. It was very well received and applauded, both for the work involved as well as the attention to detail. There was no real metric for how it would be received or if it was successful, other than completion.

There is more to design then completing a project though; it is also about the challenge and the expectations a designer has when progressing through the project that only becomes known through the process. Although it has been said before by others, design is as much about doing something as it is about taking a problem and imposing a solution to it. The same can be said

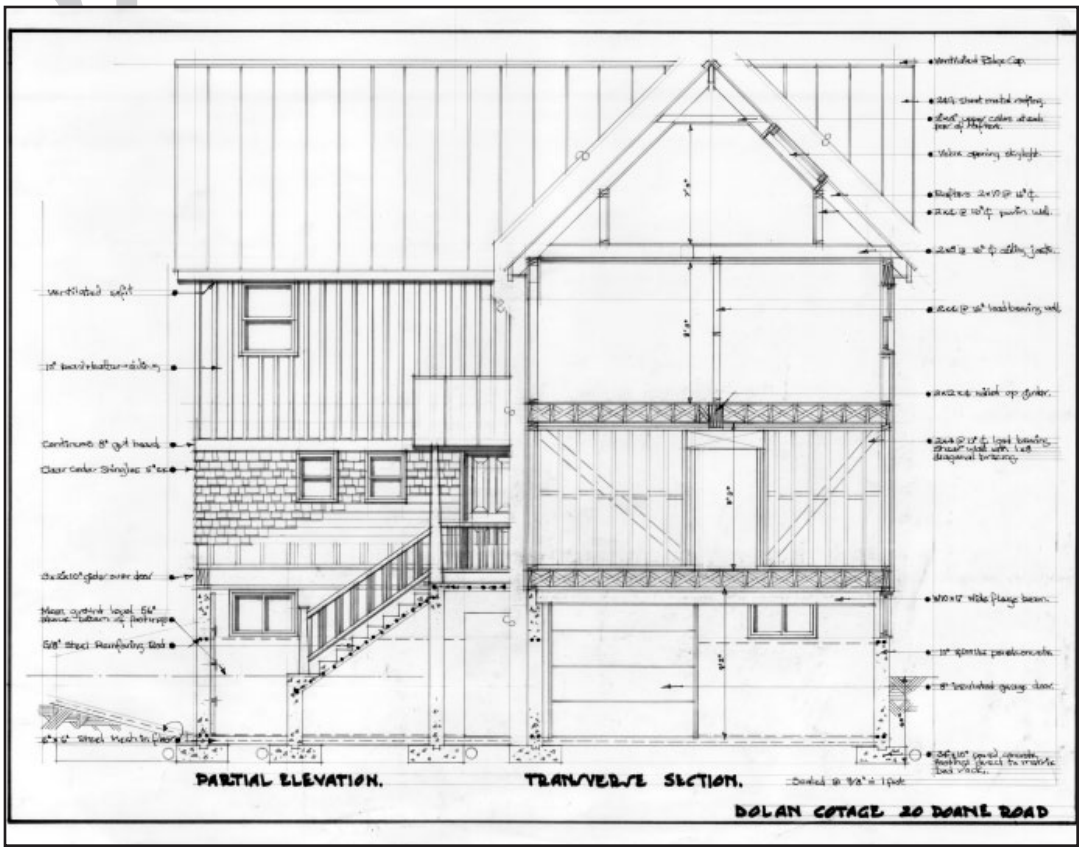
about sustainable design practices; it is a problem that we do not value our natural resources and as designers we need to look for not only innovative solutions but more solutions in general to help others see more options.

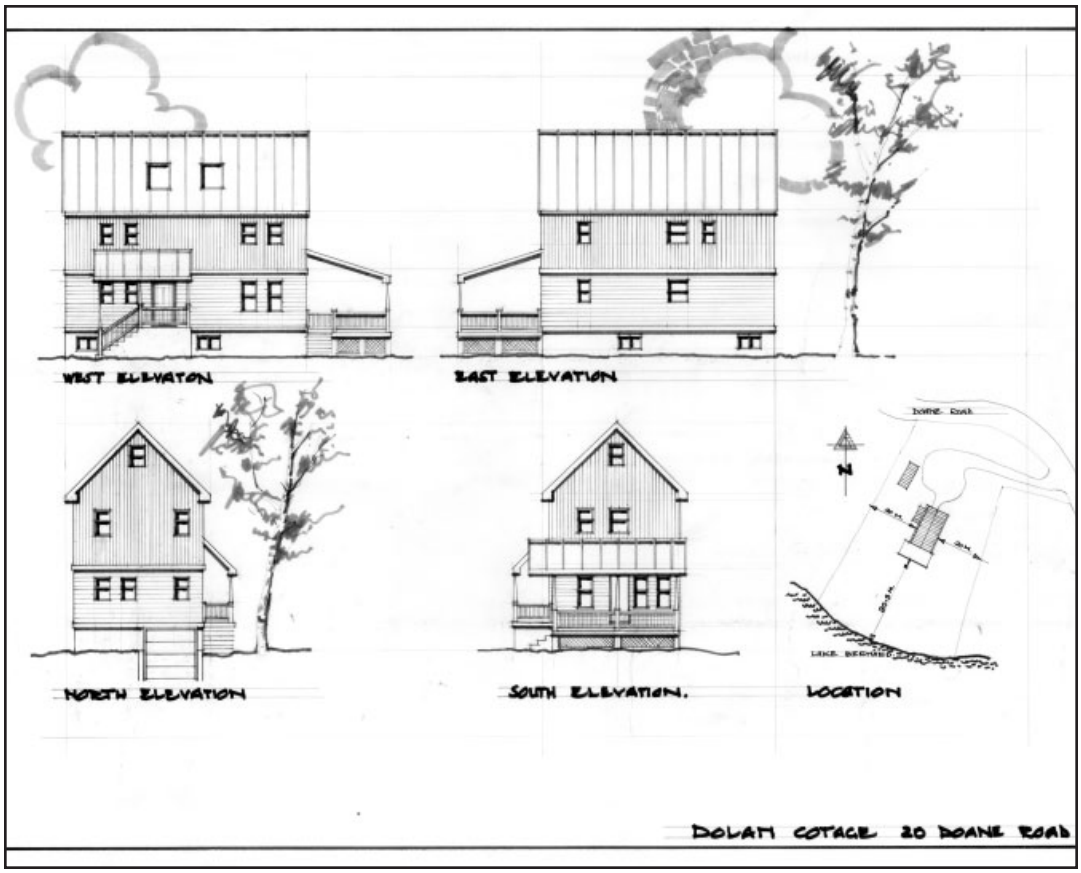
Project Conclusions

Design is about a glimpse into a methodology, which can help others understand that the small steps are as significant as the large ones. Designers often have ambitions to change society and create meaningful work that can define an era or a moment. Sustainable design is about looking to the future and understanding that everything we make will have a finite life and will need to be disposed of. These two thoughts are not mutually exclusive, they just require a bit more thought within the design process.

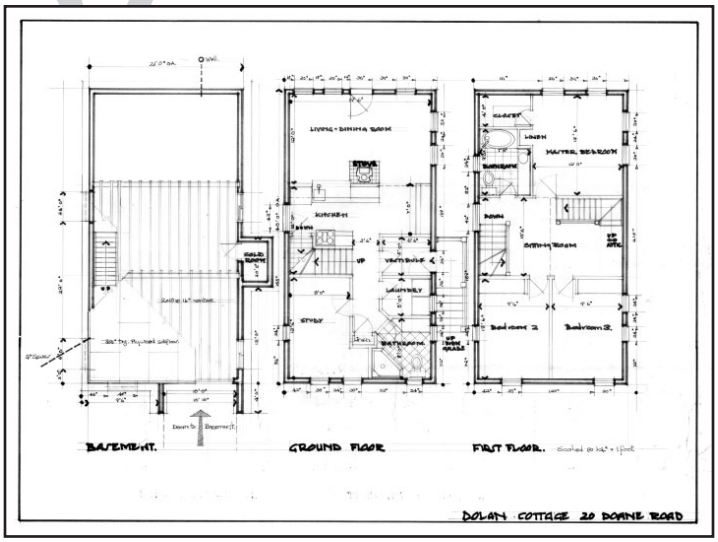
Sustainable design has as much to do with natural systems as it does with automation and industrialization. The "workmanship of risk" concept brings up the idea of a need for a workman to be able to work freehand with a hand tool at one moment and resort to a machine tool a few minutes later (Pye, 1968). This flexibility is essential to sustainable practices, being able to understand that designers need to use all of their abilities. Be it the handmade, or automation and industrialization, neither is essential to creation. This project was about using existing skills as well as learning new ones; this is a key to truly embracing sustainable design practices – learning by doing, and reflecting on what has been done.

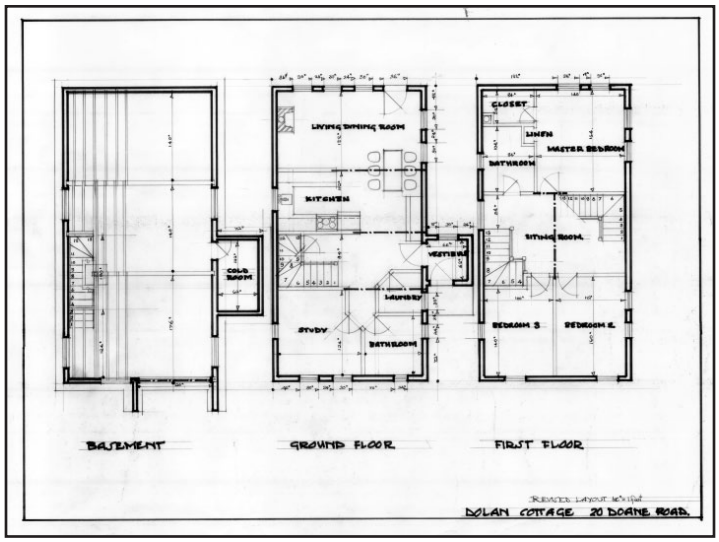
3.4 Cottage – "Emotional" Sustainability ~ Idea

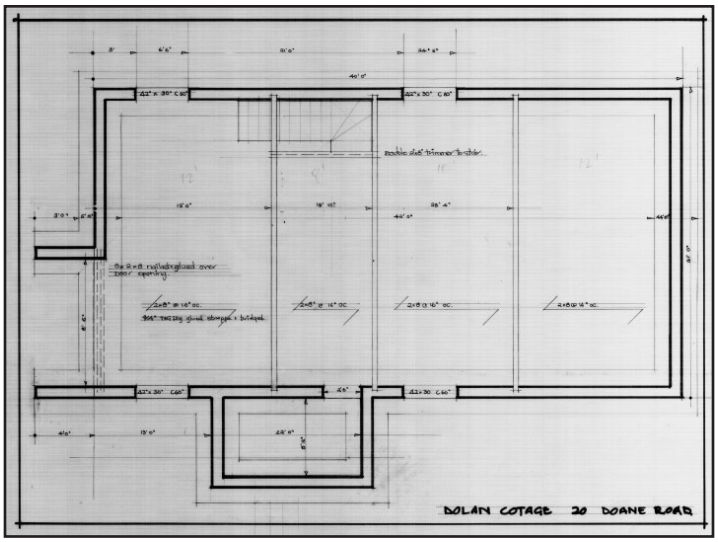


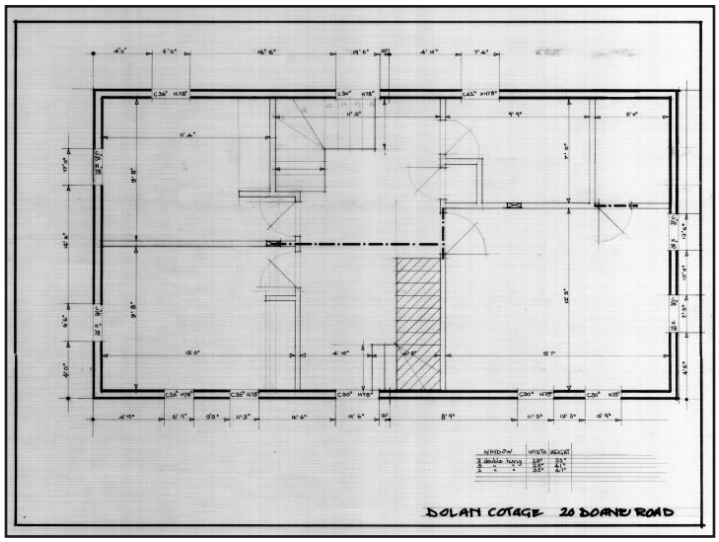


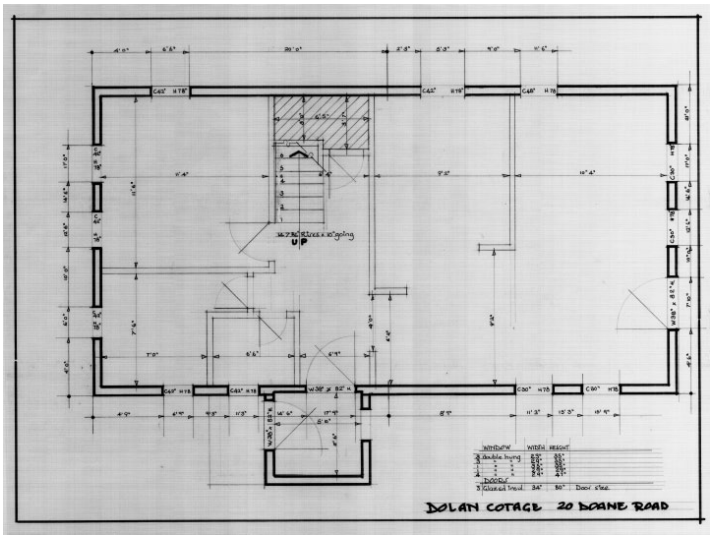
3.4 Cottage – “Emotional” Sustainability ~ Idea









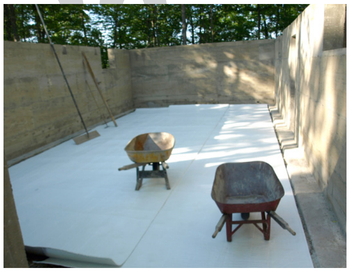


3.4 Cottage – "Emotional" Sustainability ~ Process

3.4 Cottage – "Emotional" Sustainability ~ Production/Materiality

3.4 Cottage – "Emotional" Sustainability ~ Production/Materiality

3.4 Cottage – "Emotional" Sustainability ~ Production/Materiality



















3.4 Cottage – "Emotional" Sustainability ~ Production/Materiality













3.4 Cottage – “Emotional” Sustainability ~ Final

3.5 Cottage – "Emotional" Sustainability

Sometimes the things you design mean more than the things you just buy. Creating an attachment to an object can create a different kind of sustainability, an emotional attachment. With an object you have an emotional attachment to, you are more likely to keep that object, although we often overlook this ideal of emotional attachment and look at objects only for their beauty or function. Sometimes the circumstances around where an object was bought or who gave you the object can do more to prevent that object being waste than any other factor.

Project Goal

This last project is the most important to talk about because it is not about design per se, but about the act of design and emotional attachment to a design and how through the act of making we build attachments to things/locations and processes. Throughout this thesis I have spoken of four different projects, starting with the smallest and most nebulous and ending on the largest with the least flexibility. These projects, specifically the two buildings, have helped realize some fundamental truths about what it means to be a designer, how we create and the importance of making within the design process is as important as what we create.

This project's goals were simple: create a cottage as cheaply as possible and use as much local materials as we could. Most of the sustainable elements were used by virtue of the fact that they were closer and local. By using this practice we found that materials were cheaper because they were local.

Figure 10 – Cottage: Exterior view

By using the local community we removed the cost of transportation as well as premium prices for "locally" sourced materials; we were at the source. This helped in a number of ways which didn't become evident until the project was well on its way.

As with the CVAP building this project was also based on a collaborative effort. Although in a very different way. The CVAP project focused on bringing as many different ideas to the table as possible. This project concentrated on education and following instruction. This project really focused on a collaborative approach which was based on expertise and experiential learning which is only capable through collaboration. As designers we are more often generalists rather than specialists, we need to recognize that we need to rely on others for their expertise, and insight. The myth of the Lone wolf designer is just that a myth. True design practices focus on design through collaboration. Conveniently when working on physical construction projects much like design there is a need for this type of approach learning through doing with people who have the expertise to teach the correct ways of working.

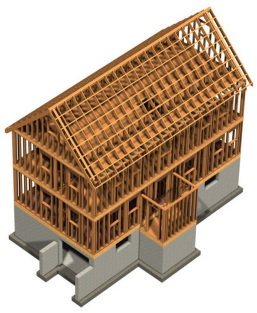


Figure 11 – Cottage: Digital Rendering

Theoretical Framework

The essential question, which needs to be explored within this section, is when we have a stake in creating objects do we become much more or less attached to those objects? The short answer is that through this process of making, our attachment becomes physically and emotionally real.

This project sits in a weird place between research, philosophy, observation, reflection and that only by going through the process do you have a much better understanding of the whole.

To contextualize this project, the project began right after the Gulu, Uganda project. It is important for the purpose of this paper to know that I did not physically build anything in Uganda. My job was purely in the abstract, planning, dimensioning, etc. - nothing physical. The plans were handed over to a local engineering firm as per our mandate in Gulu and the building was constructed by a local company. Again, this was not a problem because the building was to be built for Ugandans by Ugandans. The sense of community attachment to this project was a major part of the brief. Although I understood the theory, at the time I could not relate to the sentiment of why it's important for somebody to build something and the attachment that comes from that action.

Designers expect there will always be tens, if not hundreds, of changes to their projects and again as many changes once you start to build. Some changes are subtle and others are monumental, but things always change once construction starts. By going through this process you become much more familiar with the things you create. You learn more about the subtleties of design, things you cannot just think of on the computer or in a sketchbook.

There are realizations that only become evident when you are trying to build something. There are questions as to why things changed in the Gulu compound, but the cottage is completely understood because not only was I part of the design but also part of the actual construction as I installed one third of the nails, studs, flooring and roof.

How does all this relate to the buildings? A better question would be: how do you frame a house? I have had experience in building in the past, but not on this scale, which I only really had a superficial conception of. Through this process though, a complete understanding becomes clear.

Skill/Knowledge

This cottage has been a passion for decades for my family. It has been planned and designed over and over again, so much so that the building is talked about as a member of the family. Paul Oliver illustrates this in Dwellings, that houses are both process and artifact, "The dwelling is more that a structure as the soul is more that the body that envelops it" (Oliver, 2007); over the course of this project that has become clear, as the cottage has begun to take form. As walls went up and stories were developed, the soul of the cottage began to take shape. It was not only the act of building, but also the stories while building, which helped to define the space. The mistakes, the changes and the unforeseen all helped to define what this place would be.

Often we look at our projects as tasks that need to be accomplished, that the end result is the most important element of what we do. The deliverable is key and the path to get there does not really matter, or at least this seemed the norm. This final project is nowhere near as important as the journey to its creation. Only by going through the journey of creation do we really get an appreciation for objects we use, own, make and inhabit. By observing and taking part in

the evolution and creation of a thing we have a better understanding of that thing. By making we de-fetishize; we gain a better understanding of the costs and attributes and become more emotionally invested in it.

With the compound in Gulu, as additional people became involved, the more I was removed from the project. Over time, the building became more and more abstracted from the original plan and the further it moved away from my designs, the more alien the structure became. I equate it to seeing a baby being born, then seeing it again at 18 years old; although you know the origins of the child, the experiences changed it in very profound ways. I was surprised how much this lack of contact created a void between the idea and the final piece. To really understand an object, designers really need to have a hand in its creation. There is a need to touch the object for it to become real, or to have some kind of emotional attachment to the thing which they/I "created".

It never occurred to me that this separation between the object and the creation would create such a disconnection. The change in building techniques, of having a hand in the construction of a thing from the hole in the ground to the roof going on completely changed my experience of building. This project allow for a profoundly different understanding of the act of making, which can only come from a project of this scale. This familiarity did not just end at the building itself but continued through the materials, processes and techniques, and knowing why everything was where it needed to be.

Attachment to objects and how things become more or less important to us has become extremely interesting throughout this process. In Emotional Design by Donald A. Norman, he talks about emotional design coming from three different levels: the reflective, the behavioral and the visceral (Norman, 2004). Although he is primarily writing about why we like good design and how they endear themselves to us, these different levels can help to explain why a physical attachment during the process of creation can also allow us a level of emotional attachment. All the points that Norman uses are about sensory experiences, first through our senses, then through motor reactions, finally to our interactions with objects.

This approach comes from the constructivist and experiential learning processes. When we learn, we gain a better understanding of what we are doing through an active engagement. Paiget, Dewey, and Lewin all describe learning as being best conceived as a process and not in terms of outcomes. They go on to mention that "ideas are not fixed and immutable elements of thought but are formed and re-formed through experience." (Kolb, 2005). The more experiences we have with a given subject, the more familiar we become with those subjects. The same holds true with objects, the more information we have on those artifacts, the more familiar we become with them and consequently the more attached we become.

There were three of us working on this project: my father, his friend and me. This whole process reminded me of what Nigel Cross said about the way design was taught. "Traditionally, design teachers have been practicing designers who pass on their knowledge, skills and values through a process of apprenticeship. Design students act out the role of the designer in small projects, and are tutored in the process by more experienced designer" (Cross, 2007). Only through experience do you gain understanding

This idea relates to that of David Orr's definition of what is a requirement for ecological design, that it "…requires not just a set of generic design skills but rather the collective intelligence of a community of people applied to particular problems in a particular place over a long period of time" (Orr, 2002). These types of practices are not based on operating in a vacuum but are about developing interactions between people who know and people who want to learn and experience the act of making. It seems essential that the development of ecological design practice be based on these types of applied practices and not just on the theoretical. But it also seems as though ecological practices have, built into them, the potential for meaningful attachment.

Although "how to build" is important to this project, something became very clear; through creation you gain a connection. The example of this building it is not a superficial bond but a deep understanding of the soul of this building. I realized that the building and I had a symbiotic relationship. In Sustainable Design they mention that "…architecture gives people the possibility of empowerment to define who they are to develop consciously and independently" (Contal, 2009). This is exactly what this project has done, has empowered and allowed me to really develop a better understanding of design.

While I have had these types of thoughts in the past, it has only really become clear to me that meaningful design must be made and that a physical attachment through creating is essential. Although I designed the Uganda building, I really don't feel an attachment to it beyond that of interest. I had no stake in its construction or any real understanding of the process involved. The act of making that building really had nothing to do with me, it just exists.

With the cottage I helped build, I understand every decision which went into its construction. When I began I had no real understanding of the process but upon its completion I have a complete understanding of all of the processes and systems used to create it, from how to install the windows and doors to how the weight loads are distributed. This understanding comes from practical knowledge which helps to ground the emotional attachment into something physical and not just something which was purchased as a "want" but a thing which is made by a community.

Project Success

It has become clear to me that I have a true emotional attachment to this project. As the framing was coming to an end, my father gave me a book called, A Place of my Own, by Michael Pollan which tells the story of the author building his own one room house in the woods. In his last pages, the author says something which I can completely relate to after doing the same exercise, "I had dreamt it and had a hand in making it, a fact was more gratifying than I can say, but now looking past that, or trying to, wondering, pointlessly perhaps, about how this building I'd help to shape might come in time to shape me, where the two of us might be headed" (Pollan, 1997). The author has come to the same conclusion as I have, that things have as much influence on the maker as the maker has on their creation. They become one, two souls who have become familiar with each other through a common process.

Project Conclusion

Although the majority of the learning throughout this process has been self-reflective, it has really helped to solidify my thoughts on design as a physical, as well as a constructivist learning practice. My final feelings on this process are that, only by creating can you ever hope to understand what it truly means to be a designer. The joy I feel for this project is only explainable by going through the process. It is an amazing philosophic journey through the world of applied design because of scale and scope.

Although the emotional journey for this project is important it is only the tip of a much larger learning experience. We often think of design projects as things to accomplish but sometimes, as with the Gulu compound, there is more to learn as the project progresses. We made the best Sustainable choices as we built this building at the time of construction, but there are more decisions to be made. Multiple points of entry into the many different areas of sustainability now exist where one began.

Long term assessments, evaluation and evolution of the building from the material used on the finishing now allow for much more in-depth understanding of sustainability, not only through the creators but through the guest and family members who come to visit. The practical life and construction of the building becomes a point of discussion. Material choices and construction methodologies come up for debate, as the building lives. It becomes a learning tool for others. As interests in the process are discussed a finer lens is focused on the building allowing for a much more in-depth discussion on the subject; also, critical views and suggestions are broached.

This project has allowed for many debates such as how can we to reduce power consumption or increase power generation, is the solution solar panels or perhaps a vertical axis windmill. Another topic has been how to increase water efficiency and reduce waste, low flow toilets and grey water recycling. Composting and gardening are all now on the table to reduce the families' foot print. Everything from what finishes should be used such as natural materials or recycled has come up for debate. All of these ideas now come to the foreground where in the past they were just ideas in books and articles.

By understanding that this building is not a thing but a living evolving object it is life and effect on the world become as important as my own and if it can be made better there is no reason not to follow that thought. I was always struck by the notion of sustainability, where it is about meeting the needs of the present without compromising the needs of the future. But in this particular case the needs of the future are taken into account as family grows and technology changes the flexibility of the buildings construction as well as the skills learned to adjust, it will make this building a benefit to future generations.

The final thought on this project is that emotional attachment is as important to the sustainable design movement as any technical nutrient or technical process. In addition to this attachment, designers need to understand that time and the evolution of a project are equally important as the initial design. Creating flexibility as well as checks and balances are just as important as doing it in the first place.

3.6 Research Conclusions

This section began with the question, "How can designers change the world?"

The sad truth is every solution I have tried, even the most sustainable, has a more negative impact on the planet than a positive one. The fact is that these projects can help others. The attempt is the goal, to minimize the damage. I have tried "to be 'more good', and not 'less bad'" (McDonough, 2013) which is part of the problem. Trying new things in design is difficult, especially when we have time constraints and budgets. Knowing that you are most likely not going to be successful at being 100% environmentally friendly is a difficult thing to realize. But a step in the right direction is what design practice should be heading towards, and not lethargy. I was struck by the sentiment that was brought up in Upcycling that "if design is a signal of intention, even small steps in the right direction, with a positive and anticipatory framework, can create a ripple of effects" (McDonough, 2013). This is the point of this thesis. It's not to create something which will create profound understanding which will jump the world of design into the next century, it's to create knowledge and understanding of the theoretical frame work of the projects and goals as well as the successes of the project based on the experience of moving through them.

Designers should approach the practice with the knowledge that everything cannot be perfect, but they can create ripples which help to approach perfection in the future. How we get designers to engage with sustainable design practices in meaningful and practical ways is to let them design in meaningful ways, to understand that design has as much to do with environmental problems as an oil leaks or global warming.

"The best design also has a future. If it is sustainable." (Shedroff, 2009). These four projects show a glimpse of how one designer is trying to make a difference through sustainable design. As John Dewey says, "Knowledge is constructed through experiences (Dewey, 1929)", within design steps must be learned, experiences gained in how design can be more engaging, interesting and culturally or personally relevant. And the only way to do this is to practice.

Design is not created in a vacuum; it needs air to breath, it needs to be discussed and leaned from. I think William McDonough and Michael Braungart have it right: we need to find ways to "honour people's intentions. No one can get to perfection overnight. But people can be honoured, recognized, and encouraged for having begun in earnest. Starting is important. And creating is essential. If we want sustainably harvested wood, we not only need to source from sustainable forests, we need to create new sustainable forestry programs too. If you have planted even one tree, you deserve to be recognized" (McDonough, 2013). If you have started to design sustainably you should be encouraged and not criticized.

We have spent the last century designing in a way where we have mastered materials, techniques and form but a consequence of this is that we can no longer create for creation's sake. There needs to be a more rigorous approach to design than there has been in the past. In the past, designers asked, "why not?" The current generation must focus on "why?" and "what will happen?"

This is not to say that designer should stop creating because that is fundamental in the design practice. They need to embrace their drive to change, but in a positive way. Design needs to be about looking to the future and understanding that what is created will exist and will be thrown out. Nothing lasts forever.

We live in a culture of consumption and this is not going to change anytime soon. Our world does not change on a dime; ideas must be explained, offered, explored, discussed and re-explored. If designers are to start creating more meaningful sustainable work, it needs to be introduced early on in the design education with the understanding that the attempt must be honoured. Successes should be explored and shared, not just the failures which seems to be the standard. We need to move the conversation forward to one of interest and positive reflection.

The sustainable design revolution can be won by all. This is something I believe to be a truism of the current design era: we are at the beginning of a design revolution. Designers have more power than ever before. Western culture uses design to determine our everyday. Everything we use, touch, work with has had a designer interact with it. Designers are now responsible for our culture and meaning in our everyday lives. We need to embrace this and understand that with this comes a very important responsibility. Designers can no longer just create; they have to be socially responsible as well. Designers need to learn this very early on in their design education.

Designers learn through doing, not by just sitting back and assimilating knowledge. Design needs to be tried in ways that examine projects as steps in a larger process, not as finished things. You cannot understand how your design will work until you start working on the prototype, the mock-ups and the final process. We need to take this approach to sustainable design theory, that everything that is done has merit and has value to the conversation.

Sustainable design can be a nebulous term. Often we hear different terms for sustainable design as it can mean material, cultural, context or emotional research to name a few. What sustainable design truly means is "future design", knowing that whatever you build/create will not last forever. The key to understanding the potential of sustainable design is to open a dialogue as to different points of view on the subject. Instead of dismissing them as incorrect we need to embrace them as different ideas and points of view on the subject.

This is not to say that we need to advance based on just creating for creation sake. As I have mentioned sometimes the decision to not do something is equally important. What we need to do is create a system of checks and balances as well, by introducing subjects such as Life cycle assessments (LCA) and the natural step will allow students to explore their projects in a very quantifiable way. This will allow them to look at their work in very critical way and allow them a better understanding of the processes and materials used. As mentioned Sustainable solutions are not always straight forward and the approach to many of these projects is to explore the idea of how we move sustainable design forward to designers.

Designers often think they are innovating at the leading edge of everything, but the reality is that no one lives in a bubble. And the more people we have working on a subject, the more interesting that subject gets. Engaging in one subject from different perspectives can provide insights you never expected. Additionally seeing someone else's point of view can be as valuable

as doing it yourself. Designers need to see different ways of thinking.

Designers need to be engaged with the subject matter. In The Green Imperative Papanek writes that the job of the designer is to provide choices for people. These choices should be real and meaningful, allowing people to participate more fully in their own life decisions, and enabling them to communicate with designers and architects in finding solutions to their own problems even - whether they want to or not – to become their own designers (Papanek, 1995).

No one can get to perfection overnight. But people can be honoured, recognized, and encouraged for having begun in earnest. If design is a signal of intention, then even small steps in the right direction, with a positive and anticipatory framework, can create a ripple of effects (McDonough, 2013). By creating a framework where we are able to design a system where sustainable design is discussed in an open and success based framework, we encourage the discussion and the engagement with the subject. It will become more and more interesting and more and more accessible.

4.0 Final Conclusions

When I began this thesis I wanted to investigate the potential of applied sustainable design. This topic eventually evolved into how we as professionals can be more sustainable and how we as mentors and educators can we teach them to embrace sustainability on a fundamental level. Throughout this process I have come to a number of conclusions.

During my course work I learned of an adage that "There is no view from nowhere". This idea was rather strange and interesting. The idea is that everything we do comes from a viewpoint and that point of view is always going to be subjective. But by explaining it we allow others to explore our thinking and grant them access to our view from somewhere.

There are a number of challenges to face moving ahead seriously towards global sustainability. Design is not a practice which sits still; it is subject to many factors which make it a constantly evolving body of knowledge. Designers need to understand that they must be flexible in their thinking, able to adapt to new things like material studies, climate change, understanding recycling and upcycling, as well as the myriad other factors which affect our daily lives.

To truly be sustainable we need to address and understand that the things we use everyday are subject to technological evolution, planned obsolescence, technological obsolescence and over consumption. All of these ideas need to be addressed within any good design education. It is critical that we recognize that these theories directly implicate designers and cannot be forgotten or dismissed. Tools such as Life Cycle Assessment and other methodologies will help designers to get a better handle on these effects and they are only going to get more and more robust, allowing us to truly track down all the environmental effects of the things we produce.

The second thing we will need to address is to introduce these concepts into design education. There will to be many challenges to teaching the concepts I have presented in a rigorous manor. With the subject being so broad and deep, it will have to be approached one step at a time. We should try to use principles which allows students who are capable of evolutionary design thinking, not just focusing on methods and materials, but on larger issues such as global effects of the things we create, the impacts of resource extraction, the waste we are potentially creating,

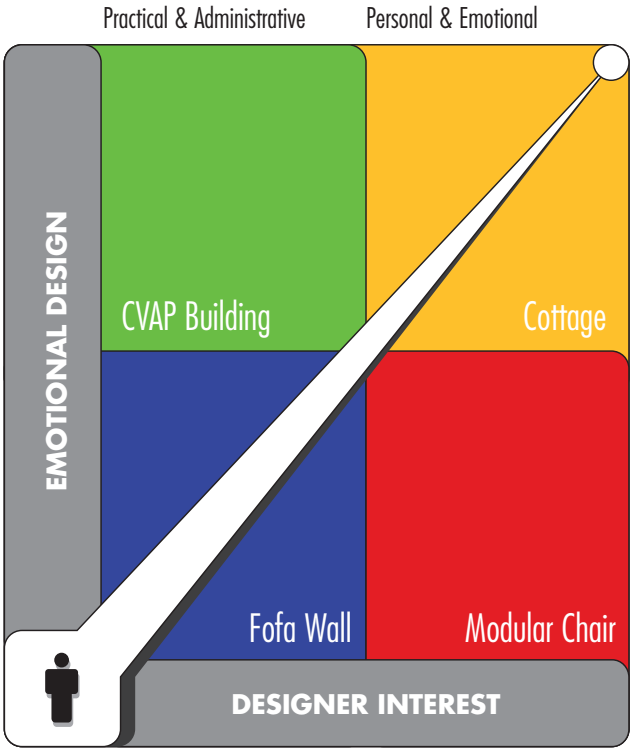


Figure 12 – Emtional Design vs Designer interest

and how we create meaningful things do not end up in the garbage after a single use, to name a few.

Sustainable design needs to moved forward. I began this process by looking at the problem from a collective perspective to a global problem. These types of practices will become more and more relevant as natural resources become scarce, as populations grow, and as the global south starts to become like the global north. We need to look at the future of everything we create and not just how it will exist or be used once it is created, but the entire life cycle of the product from cradle to cradle. This is not something which will happen overnight, it needs to begin with individuals who are interested in looking at their practices for ways to make things better which is the one thing designer are great at.

The last thing is which needs to be addressed is this work was created a focused on the individual designer or small groups. Critically speaking this could be problematic, if not addressed. This document presents an argument from an opinion which can be biased to a number of factors, gender social status, upbringing, etc. My practice does not focus on electronics which can be a criticism of this thesis; a perfectly rational question would be how do you apply this methodology to a technological practice because it is so ubiquitous within design education? I focused on the handmade and objects without electronic components, structures and furniture. By going through this process I have realized that this is a complex problem and there is not one solution. What I investigated was what interested me, which is my bias.

Another problem is that the majority of this knowledge is reflective and very specific to my perspective; someone else going through the same process may come to a completely different conclusion. Focus on the individual creates a Knowledge base and personal narrative which allows access through common experience and interest. By approaching this through emotional attachment and Designer interest we allow access to engage with sustainable design practices on a much more personal level. My hope is that through my observations and interested in the tools, methods, and projects someone with common interests can use what I have written to take the same journey that I have and will find this information interesting and potentially relevant.

Appendix 1

I have been fascinated by teaching as I believe it is one of the noblest of professions, if not the noblest, and an art unto itself. Sustainable design is a new and interesting field right at the forefront of a new cultural movement based on the attempt to be "less bad" through the things we make and consume. We need to start integrating sustainability into design thinking in a meaningful and engaging way so that students use this information as a primary thought within their practices.

The following section is based on this concept, with the goal being that we need to start somewhere. This is not just presenting information, but presenting it in a way which the students are able to assimilate and use. Designers want and need to create; that is the one truism about all design theory based courses.

My research projects were based on this type of thinking: how can we engage with sustainable design in a way which is easy to understand and use within design education? The key is not only to explain the theory but to allow design students to experience processes, applied practice and then reflect on the whole project in a way which is critical.

The projects I undertook were much larger than any practical multi student courses, but the experiences, as well as the reflection on these projects, has helped to identify and expand some theories which will help to engage students within the domain of sustainable design.

The major theme of this class is that there needs to be a rigorous exploration of the field of sustainability but in a meaningful way to students. This idea is taken from Tim Brown in Design by Change where he mentions that "in general people steer clear of projects with uncertain outcomes out of fear that participation may damage the chances at advancement." Which is true in any Academic setting were the end result for most students is the final grade (Brown, 2009). Sustainable design needs to be accessible but explored in a meaningful and critical way. This is to say that we have moved from the idea that we need to build thing to building things, we need to explore the idea that what we make as designers has consequences.

Life Cycle Assessments can and should be used as a teaching tool to broaden the discussion as part of the design process. This will allow more in-depth discussions on materials and processes. The positive as well as negative aspects of the works should be explored. There will a focus on ISO 14001 environmental assessment tools to help with critical analysis of the projects being produced. These tools are relevant to this type of practice because traditionally, environmental management systems have been location-based, addressing the impacts of local activities on the environment which is no longer relevant to today's global economy. With specific mention to what can be done differently to make projects more sustainable.

There will have to be a critical approach to the design process that is a given but the overall tone is to create an environment where students will think about their work as something that is useful, positive and in flux. Within the academic setting is really the only place where designers will not have to worry about their projects being mass produced or the material choices being so harmful that they will cause problems to others. It is a setting for exploration and learning. As you might

have noticed, I have learned more from my errors than I have from my successes. This is the nature of the process.

It is also essential that the process moves forward in a positive way. Positive encouragement does not require the pretense that all ideas are created equal. If something is not sustainable it needs to be addressed as well. But it should be done in responsible way, which will inspire confidence, if people feel that their ideas have been given a fair hearing it will encourage them (Brown, 2009). An advantage to a positive approach is that, as Roger Martin argued, it will allow students to attempt things which may not meet the definition of sustainable design but will allow them to explore opposing ideas to construct a new solutions. Sometime explaining why something is not correct can be as useful as doing it correctly (Martin, 2009).

The goal is to discuss the project in a way where the successes are encouraged. This is to connect with the second level of design knowledge creation, the reflective practice. "No one can get to perfection overnight. But people can be honored, recognized, and encouraged having begun in earnest" (McDonough, 2013). Taking this approach will encourage the understanding, value and interest in creating works within each of these subjects, without the worry of being "Correct" but rather looking at the attempt for what it was an attempt.

The rationale of this second section is to create a way of exposing students to a number of varied approaches, theories and methods of that given subject matter. It is a given that design is a varied subject, nebulous at times, but so are designers and their interests. It would be impossible to explore all of them in a single course but through the implementation of reflective practice you can expose designers to things they may not be interested in and that sometimes are as important as actually implementing them.

The aim of this class proposal is to implement a small size class of less than 25 students. This will allow interactions that include everyone in the class, as well gives the instructor the opportunity to discuss each project in a meaningful way. Small studio classes allow for much more interaction with the students as well as much more open dialogue within the class itself.

Studio classes with more than 30 students are too large to effectively run a critique, which is essential to this class. Inevitably with large classes you end up rushing through presentations and critiques in order to make breaks or the end of class. This is not to say that large classes aren't effective at theory based information or large group discussions because they are. For the most part they are great at creating and presenting large bodies of opinions and options but less effective as studio classes.

To further that end, the goal is to create a course framework which will allow the individual designer the opportunity to experience, explore and be exposed to a number of sustainable strategies, based on established design principles, using interest as well as peer discussion.

Students will be expected to design within two of the four frame works discussed within my research projects.

Materials are an obvious frame that students could explore with expectations of looking at a

sustainable system or methodology in order to create a sustainable design. This could include modular chairs, or bio degradable bags, etc., something where the materiality is important to the object's sustainability.

The second area in which the designers can create is Context. This would include looking at creating a recycling system, bicycle exchange, etc. to develop a system where the net result is a benefit to society in aiding people's behaviour to be "less bad".

The third area is Cultural. This would include urban practices, greening, outreach, an information project, etc. The goal of these types of projects is to look at a larger project, something to help a community, not just individuals, but a group of people to bring the notion of sustainable design into the common dialogue.

The last area in which design students will be allowed to work is the Emotional. Sustainable design is not always about creating something totally neutral within the environment, but sometimes it is about creating something which has value beyond the superficial. It appeals on a much deeper level, something that will never be disposed of because of its emotional value.

These are four areas I have identified as important to meaningful engagement within the field of sustainable design. Students should have a sense of selection and personal choice which is why creating areas that can match their interests is important. Imposing projects on students with very tight constraints is as ineffective as vague projects with no directions. Designers thrive within the boundaries of rules. These four themes are enough to get started and to constrain the results, but are also diverse enough that they can create an emotional involvement and interest with the work they are creating.

The secondary objective is that students will be required to analyse another student's work, to look critically at their approach as well as their sustainable methodology. Students then create a document which discusses the successes of their colleagues' process, again focusing on the attempt and the theory, not necessarily the result. In theory this should expose the whole class to all four methods of applied sustainable design practices, through discussion and interaction with

the rest of the class.

The project structure is based on allowing students to experience the process, walk through, and then repeat the process again. Often classes are structured in a one and done approach, and usually it is only once the class is finished that students appreciate what they have learned. Within this structure, the students are not expected to repeat the same project but they are expected reproduce the system so they can take what they have learned from the first experience and use it in their second attempt with a different subject.

The essence of this course is that designers need to practice. Design is often thought of as the physical manifestation of a creative idea but design education needs to focus on the theory as well as the application of the process. It's not just about focusing on the theory or the practice individually, something that often happens. If it is true that designers create culture and meaning, then they have a massive responsibility to create responsibly and ethically, not just to make.

The following course syllabus is an example of a sustainable design course structure.

Appendix 1.1: Sustainable Design Research (Class Syllabus Proposal)

Requirements

This is a third year course for no more than twenty-five students. Students should have the fundamentals of design practice, such as understanding of construction as well as third year computer skills. This course is about positioning design as a larger part of culture as well as the understanding that design is an essential issue within global consumption and waste.

Course Description

If design is a signal of intention, even small steps in the right direction, with a positive and anticipatory framework, can create a ripple of effects.

- William McDonough (2005).

This is a theory-based studio course, which highlights sustainable design practices, encourages exploration, and success based discussion, the focus is on what is done right rather than the negative aspects of the projects. The goal of this course is to engage with the different ideas of sustainable design practices. Students are encouraged to explore and broaden their knowledge through research, practice and reflection. They will learn the theory and apply the practice of the new culture of sustainable design.

Evaluation

The evaluation will be based on three areas: applied thought process, sustainable rationale and construction/finish. The purpose of this course is to learn, create and discuss the merits of sustainable design through multiple avenues of exploration and discussions. There will be three projects.

Parts 1 & 2: Applied Design

Students must select two of the following areas of sustainable design:

- **Materials:** a material or process that has a net positive effect on the environment (ex: design for disassembly, eco printing, "cradle to cradle", etc.)

- **Context:** a project that introduces sustainable design into an area where it brings attention to sustainability in a subversive or overt way (ex: recycling system, eco bags, bicycle exchange, etc.)

- **Culture:** something that helps society in a positive way, (ex: urban greening, outreach, information project, LEED certification, etc.)

- **Emotional:** create something, which by virtue of its creation for someone or cause will last longer than other wise. (websites, posters, jewelry, craft object, something very personal, etc.)

- **Mash-UP:** any combination of the above, combinations must be stated before beginning and choice for combination must be justified.

Once selected, students will be expected to develop one design within each section chosen, for a total of two projects worth 30% of their total grade. Students must justify this choice within their proposal.

Students will be expected to take extensive notes on the sources for all elements they are using within their projects. This can be in any format they choose but must be accessible and easy to read. This will be given to other students for the review project.

Part 2: Review

Students will be expected to select one other project from a fellow student and write a critical review of the project based on the successes of the project. This will be presented in the form of a visual presentation as well as a written document between 1,000 and 1,500 words. Students will be expected to demonstrate a comprehensive and practical knowledge of how a sustainable design practice is not only necessary but essential within the domain of design.

Objectives

This is, in part, a theory-based course with a studio component emphasizing success based sustainable design practices. The focus will be on what is being done correctly and not what has failed. The theory taught in this class should enable students to analyze, create and incorporate concepts into their design thinking, their process and finally production. Additionally, this course should give students the ability to communicate the benefits as well as failures within contemporary consumer design. Students will be learning and developing a wide range of design thinking specifically within a very broad area of applied sustainable design. Construction techniques and material processes will be explored in order to help realize projects as needed. The focus is on self directed as well as group learning.

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