Spring 2007 Master of Architecture Thesis Project, Victor Tvedten (advisor: Wilkins)
A. Alfred Taubman College of Architecture + Urban Planning, University of Michigan

Recycled Content:

This thesis examined the lifecycle process of manufacture, consumption and disposal by analyzing how a banal waste material, cardboard packaging, an inevitable byproduct of exchange between production and consumption, could be applied to the common practice in architecture of using a local surplus as construction material. Reusing a ubiquitous yet overlooked waste material stimulates new interpretations while conserving natural resources by reclaiming its embodied energy. Construction with cardboard has broader implications in architecture to create structures which can be recycled or biodegraded for a more streamlined return to the flow of industrial and ecological cycles and thus will have a minimal environmental footprint.

My thesis took the observation that 80% of the products we buy are thrown away within the first six months, and in turn posits "How can consumption can be reconfigured to have a positive rather than negative impact on the environment? How might architecture be adapted to benefit environmental quality through it's lifecycle?"

Before recycling became mainstream, consumers used a product and threw it away with little regard for where it went. The stages of lifecycle: manufacture, use and disposal, were separate and autonomous. Today consumers are often active participants in the *before* (manufacture) and *after* (disposal) of a product. Environmental products ask more of their consumers: to be informed and proactive about their past, present and future. Consumers now consider the lifecycle of a product by asking not only "Where did it come from?" but also "Where does it go when I'm done with it?" These questions represent the immediate gratification of owning a thing followed by the remorse of eventually having to throw it away, and further symbolize the lifecycle of birth to death. Smart product design integrates the lifecycle of manufacture (birth), ownership (life), and waste (death). Architecture should adopt a similar strategy of recycling. Users of a space should participate not only in the consumption but also the disposal of the empty vessel once they are done using it. Integration of user with the lifecycle results in sustainable design. Environmental product design imparts the user with a dutiful connection to the materials when they are taken to the recycling bin and further punctuates the satisfaction of the consumption. I wanted to translate this same feeling into architecture, to get people motivated about buildings we could recycle when we're done with them.

Architecture, like the clothing we wear, is a material manifestation of the personal convictions we wish to promote. How might architecture honor its materials by telling their story of fabrication and disposal?

The typical approach to architecture has been to make a building steadfast against the elements, as permanent as possible, seeking to overcome nature rather than coexist with it. This creates architecture that is resistant to change, which complicates lifecycle

evolution, and utilizes cradle-to-grave materials that are difficult to recycle into the environment. If architecture were instead designed to be modified, upgraded, or reassembled, it would become a more consumable product. Shorter lifespans are more able to adapt to changes in demographics, climate, homeowners who relocate every few years, and rapid updates in technology. Short lifespans yield faster evolutionary cycles, thus minimizing obsolescence. Choosing a shorter lifespan forces one to better consider the disposal phase. Architects can incorporate restoration and recycling at the onset of design. Beyond simple selection of materials, attention should also be paid to their installation and removal. Building with recyclable material rather than crowding landfills with construction waste. Impermanent architecture leaves a lighter footprint on the land.

Because I working with themes of impermanence and transience, I initially decided to pair prefab housing with the concept of short lifecycle due to the nomadicism commonly associated with prefab homeowners. I selected the program of prefab housing as a way to intervene within the fabrication stage of material lifecycle by combining a recycling facility with the prefab manufacturing assembly facility to explore the methodology of closed-loop material production. Operating in the prefab sector would allow my concept of using a waste surplus to be deployed on a mass-produced scale. I also chose to work with prefab because I liked the idea of the house as a DIY Kit-of-Parts which would foster a stronger connection with the owner and the lifecycle of the house. As such I was experimenting with components with snap-together parts and demountable panels that would allow users to adapt their home to changes over time in climate or present needs and more importantly facilitate assembly & disassembly of the parts for recycling at the point of disposal or demolition. One of the ways I explored this concept was to design one component of the building holistically. I designed a wall panel that is fabricated from several generations of recycled paper. The components are cardboard framing, cellulose insulation and paper pulp surface treatment. I was thinking of the house as an empty container that is recycled after its use to make further packaging.

One of the goals I wished to accomplish was to create architecture that consumes itself; or more precisely recycles its own construction material through its use cycle. I was fascinated by the idea that construction waste could become compost and be fed back into the life cycle, similar to the Ouroboros legend of a snake eating itself. In order to portray this symbiosis with nature, I started to incorporate vegetation into the designs. Initially I experimented with a hydroponic green façade made of recycled felt and rubber that might also be used as a rainwater/greywater system, but this was again a rather literal interpretation of the design concept of thinking of the surface as a living skin, and literally organic, or edible, architecture that would be symbiotic with its natural surroundings. I felt it was important to have an actual living organism part of the design to reinforce the lifecycle depiction theme. I felt that if people could witness the passing of the seasons they could be more in tune with the lifecycle of the building. So I worked on ways of how the architecture could portray the erosion of time. This diagram shows how a façade might develop a patina as it grows old thus signaling the time for its disposal, recycle and replacement. I liked the idea of an architecture that sheds its skin, drops its leaves, or changes its clothing in response to the seasonal patterns of time. I

thought this might foster a deeper interaction of the user and the building's lifecycle and perhaps invite participation in the disposal phase. Because of the typically long lifespan of buildings, regard for their disposal is postponed indefinitely. The large divide between use and disposal breeds negligence. If buildings had to be replaced more often, more attention would be paid to their total lifecycle and would encourage greater involvement from both the users and builders.

However the prefab house proved to hold too many preconceived notions of what it should be which limited the scope of the thesis. And I also acknowledged that I was fitting cardboard into a very literal translation of conventional framing materials, basically making lumber. While lumber is produced on a mass scale, and thus focused the topic on consumption of resources, the framing of houses is a largely predictable and inconspicuous item that does not have much consumer appeal or visibility. I was using an unconventional material in conventional ways, which does not produce new and different interpretations for the thesis. So I switched the program from prefabricated assembly to a more abstract land use that would focus solely on the architecture's integration with the landscape. This would allow more interpretative forms to emerge from the cardboard. I started looking for more embedded applications for cardboard to work with landscape.

I sited my design proposals in the Arboretum because I wanted to focus their context on ecological interaction. The proposals are meant to be temporary and seasonally situated. The Arboretum made an excellent location because it is the site of so many cultivated species and there is a potential there to have a design dialogue with nature and play biomimicry.

One of the most intriguing qualities I found in cardboard was its organic feel and fibrous texture which make it ideal as a growing medium substrate, or biodegradable compost. The sporb is a seed pod made of vacuum formed recycled cellulose fiber that sprouts seedlings in unexpected places, which makes the lifecycle process visible. Transforming waste material from a negligible object to a noticed phenomenon. The sporb embodies the idea of a closed loop material recovery system in which waste paper made from cellulose is then used to cultivate new feedstock for creating more paper, the cradle to cradle philosophy of closed-loop material production. The sporb represents the desire to consume waste material in a designed fashion rather than simply discarded as detritus.