

Trash Tectonics: Experimentations in the Transformation of Waste

“Everything can always become something else.” – Charles Jencks

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The contemporary condition is oversaturated with the discarded artifacts of modernity. There are not enough landfills to conceal the excessive detritus of mass-production. This clutter is embedded in a system of global trade that operates through the shipping container. When purchasing products, one does not only get an object that will likely be discarded in a matter of months, they also get the paper, foam, and plastic materials that have protected the object en route. Is it possible to find opportunity in this global scale of excess and waste? Can we find a resource for architecture in the processes of global trade and shipping? Can the discarded materials of throwaway consumerism be linked to architectural production?

The objective of this essay is to trace the evolution of the trash tectonic from the ready-made fascinations of modernism to the current practice of upcycling. This lineage of waste transformation is the foundation for a research studio at the University of Virginia, entitled Trash Tectonics. The essay will evaluate the experiments of this Spring 2013 studio and speculate a future trajectory for the methods of upcycling in architecture.

Upcycling is the procedure of converting waste materials or useless products into new materials or products of better quality or for better environmental value. It is a concept introduced by William McDonough and Michael Braungart in *Cradle to Cradle* where the goal “is to prevent wasting potentially useful materials by making use of existing ones.”¹ This is a process of re-appropriation that is dependent upon jettisoning functional associations in an attempt to find new possibilities that improve upon past stigmas. To upcycle an object you must remove it from its contextual base and repurpose it as an improved condition.

AD HOC PRECEDENTS

The methodology of upcycling is rooted in one of modernity’s overarching doctrines: the cult of the everyday or the *bricolage*.² The bricoleur is a label

coined by French anthropologist Claude Lévi-Strauss that describes one who “is adept at performing a large number of diverse tasks; but, unlike the engineer, does not subordinate each of them to the availability of raw materials and tools conceived and procured for the purpose of the project”.³ The bricoleur is interested in the resources that are most readily available despite the functions and preconceptions associated with them.

The bricoleur’s approach to construction transmits a spirit of adhocism, a term first used in architectural criticism in 1968 by Charles Jencks.

“Basically it involves using an available system or dealing with an existing situation in a new way to solve a problem quickly and efficiently. It is a method of creation relying particularly on resources which are already at hand”.⁴

It is from adhocism that a theoretical framework for upcycling emerges. It is a technique of creation that exists outside of an organized, regulated material market. Upcycling is about immediacy and excess; it involves taking resources that are leftover, discarded, or archaic and re-associating them to an urgent purpose. Upcycling is a process of solving problems with the material at hand, which in today’s consumer driven societies is manufactured waste.

This exercise of upcycling is directly associated with the “ready-made” object, a preoccupation for many artists of the early twentieth century. The conception of the ready-made by Marcel Duchamp, positioned the found object as a raw material for intellectual contemplation. He purposely selected objects that were ubiquitous and visually mute - a bottle rack, a bicycle wheel, a urinal, a snow shovel - in order to challenge the void between “indifference” and “attraction”.⁵ Duchamp’s ready-mades were experiments in re-appropriation by perception.

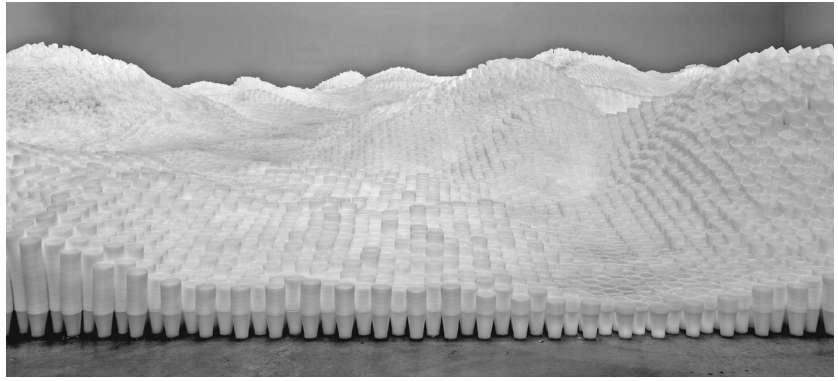
Upcycling as a conceptual process began with Duchamp’s *Fountain*. In 1917, he re-appropriated the everyday object as a new material, in a new environment. *Fountain* extracted the mundane, utilitarian urinal from the bounds of a prescribed function and placed the object within a foreign context: the gallery. The act was a transformation.

Duchamp was largely fixated on the transformation of the everyday object as a conceptual revolt against the craft-based art that dominated art discourse. However, Kurt Schwitters, Duchamp’s cohort in Dadaism, incorporated the discarded object as a component of aesthetic construction. Using collage, Schwitters moved beyond object contemplation and exploited detritus as a facilitator for composition. In his various *Merzbau* constructions, assemblage is created by continuously manipulating and combining various discarded objects, found materials and human excrements.

“The Merzbau involved two dimensions. The first dimension consisted of a crafted architectural structure made of plaster and wood, and built up along multiple, irregular axes. The second consisted of an inner core, a formless accretion of discarded random objects and fragments.”⁶

Schwitters’ collages transformed waste by means of relations. By establishing calibrated visual relationships between various abandoned object-types, the discarded material is stripped of its association and becomes a component of a new entity - the composition.

The act of re-appropriation initiated by modernism and the likes of Duchamp and Schwitters created a visual acceptance, and perhaps even an aesthetic



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desire, for the materiality of trash. Collage became the mode of operation because it was a technique of stitching, pasting, and slapping together materials ripped from their everyday functionalities. Second-hand, found material became romanticized for the rustication, disfigurement, and embodied cultural narrative.

AN AGE OF GROUPING TRANSFORMATIONS

Today, the artist or designer working with the re-appropriated object tends to focus more on a narrative of material transformation. Much of this work builds on Schwitters' assemblages and the approach of amassing waste to become parts of a whole. However, today the techniques tend to be more systematic, and material assemblages are limited to single object types rather than a collage of diverse materials. This often yields field conditions that are constructed from the propagation of a single material unit or object. The effect is a transformation induced by object grouping.

Much of the contemporary art that experiments with upcycling as a process for material transformation relies on retaining identity through the displacement. The object or material must retain some resemblance of its original state in order to convey a narrative. The ingenuity of the work occurs through the precise calibration between complete alteration and subtle adjustment of the material state. Scale and vantage point often play a role in blurring recognition of the original object. This can be seen in the work *Fat Monkey* by Dutch artist Florentijn Hofman where a large scale monkey is constructed at the edge of a Sao Paulo park in Brazil. The monkey is clad with colorful flip-flops that form a tiling system. Up close, the flip-flops are recognizable, but the views from surrounding skyscrapers reveal the objects as a smooth gradient of color.

Accumulation and aggregation are often employed as techniques for transformation. Tara Donovan is a contemporary artist who works within the realm of aggregation of the everyday object. Donovan's work creates a dramatic tension between what cognitive neuroscientist Uri Hasson calls "activation induced by local object features and activation induced by holistic, grouping processes that involve the entire object or large parts of it."⁷

"In Donovan's *Untitled (Plastic Cups)* 2006, a 50'x55' terrain of stacked plastic cups, an undulating field emerges from a pixelated array of everyday cups...Donovan uses anonymous elements of the real to make original otherworldly structures that complicate the relationship between parts and whole and reconfigure our ideas about and memories of utilitarian objects and real and imaginary terrains."⁸

Figure 1: Tara Donovan's *Untitled (Plastic Cups)* 2006, a 50'x55' terrain of stacked plastic cups.

Tara Donovan assembles the commonplace object as she would any material unit. Donovan's work presents a pivotal moment for material transformation, where the modernist's tendency to fetishize the object has been replaced with a tactic to use the object as a subsystem. The object's initial function is disregarded and it is perceived purely as a unit for construction. The geometries and material properties of the object become cues that explain how to aggregate the unit to a collective material system. This is the creation of fields from objects.

"Objects gain their value through the situations in which they are placed - in other words, what defines the value of an object is not the material it is made from or the function it serves, but its position in a context."⁹ Schwitters' collages employed object relationships to redefine function and association. Donovan on the other hand uses excessive accumulation of a single object-type to disintegrate the edge and identity of the object.

TRASH TECTONICS

While the upcycling of the everyday, discarded object is firmly rooted in the bricolage fascinations of modernity, its appeal for architecture today lies in the ecological discourse. The ecological mandate of upcycling relies on the development of methods for remediation by transforming waste into productive material. The key for implementing upcycling in response to an ecological mandate is evaluating the embodied energy in the material transformation process. This encourages a ready-made approach over energy intensive methods of reprocessing material compositions. In upcycling, material transformation is achieved by low-tech and innovative strategies of assembly. This initiates a process that lies in the field of design, rather than that of material science or manufacturing. The ready-made strategy for upcycling is dependent upon connections, joints and details; it is a doctrine of *Trash Tectonics*.

Trash Tectonics is an undergraduate architecture research studio at the University of Virginia's School of Architecture that focuses on the transformation of waste, excess and the ordinary into new spatial and material realities. In this studio, students work predominately at full scale to investigate material prototypes and assemblies developed from collected waste products. Material transformation is employed as a life extension technique for detritus. The work presented here are results from the Spring 2013 studio.

The studio examined three conditions of material waste: *the discarded*, *the outgrown*, and *the remains*. *The discarded* are the throwaway materials that package the products we consume. They have no specific function beyond transporting items. Examples of *the discarded* include plastic packaging, expanded polystyrene packaging, bottles, cans, cartons, boxes, packaging peanuts, bubble wrap, pallets, etc. *The outgrown* are the products and materials that are time sensitive and are abandoned after their performance is deemed outdated or inadequate. This form of waste has been accelerated by the short life cycles of electronics. Examples of *the outgrown* include cell phones, televisions, computers, toys, clothes, tires, etc. *The remains* are the leftover materials from industrial, manufacturing and construction processes. It is the material that is removed during the formatting of standardized materials and objects. *The remains* include scraps, debris, dust, chips, shavings etc.

The studio reconsidered these forms of material waste as raw material. The provocation for the work was stimulated by four pressing questions: What if



Figure 2: FREE BUILD 1, a tool bag made of plastic bags and cereal boxes. Project by Nancy Cronauer.

Figure 3: Details of FREE BUILD 3 trash tectonic prototypes: plastic bag roofing system, newspaper brick rolls, pepsi bottle wall and pop-tab membrane.

architecture was constructed of 99% upcycled material? What if spatial formation emerged directly from the assembly logics of this upcycled material? What if we eliminate the need for raw material by re-appropriating all waste? What if design and construction occurred simultaneously?

Trash Tectonics was a design studio that operated under the format of a construction laboratory. Design occurred in parallel with the act of building and making. The process privileged the tangible over the intangible; the built over the drawing. This laboratory operated outside of the abstraction of scale by continuously exploring the consequences of design and construction at a one to one scale. The students came to realize construction as an exercise of both mind and body.

Prototypes and constructions were built and tested at the Milton Airport Hanger, a decommissioned airfield nine miles from the School of Architecture. This location acted as the project site for the studio. It is remote and lacks most contemporary conveniences such as internet, heat, and air conditioning, but the location is a dumping ground for the university facilities. Thus, it is a rich pallet of orphaned materials which aid in the student constructions. The situation established a sense of nostalgic radicalism as the studio retreated into the woods to experiment with trash, using no computers, no drawings and no models.

The semester was organized as a series of FREE BUILDS. A FREE BUILD was defined by two meanings:

- 1 - to build with little or no monetary expenses for material or labor.
- 2 - to build without a master plan or predetermined form.

Form and organization emerged directly from local conditions, resources and decisions. These FREE BUILD assignments started at an object scale and advanced in size and complexity as the students refined their methods of transformation and familiarity with construction tools.

Throughout the semester, students acted as scavengers, combing the local environment for waste to use as raw material. The exercise illuminated the realities of material availability and the excess that exists within local systems of supply and demand. It was a pragmatic, somewhat parasitic approach to site analysis. In this mode, design cannot proceed until the material source is determined and secured. Discussions of form were forbidden until after full-scale material testing.

The material constraints for the studio's work emerged from a theory of adhocracy: find a material source that is locally abundant, free, and accessible. The objective was to stockpile enough material to test, mock-up prototypes, and finally build a full-scale spatial environment that reinterprets Marc-Antoine Laugier's theory of the "primitive hut".¹⁰ The constraint of the studio prompted full-scale construction for less than one hundred dollars, the cost typically incurred by an architectural student for materials and supplies in a traditional "design studio" setting.

The time and budget constraints of this project catalyzed a condition of the "local". There was no time to venture outside of a comfortable driving distance. There was no money to have materials and supplies shipped in from distant suppliers. Thus, the constraints instigated the methodology of the

bricoleur. Material experimentations included plastic bags, newspapers, bottles, cans, paper tubes, wood pallets, human hair, compact discs, vinyl records, polystyrene, tires, junk mail, plastic cups, construction debris, aluminum can pop-tabs, VHS tape, and wood chips.

FREE BUILD 1 was a short exercise that acted to facilitate the acquisition of skills in scavenging, transformation, assemblage, and improvisation. The exercise was to build a small container for the transportation of tools or materials to and from the studio's construction laboratory. The project specifications called for a container that fits under the studio desk, is made of 95% upcycled material collected from home, and is transportable by one person.

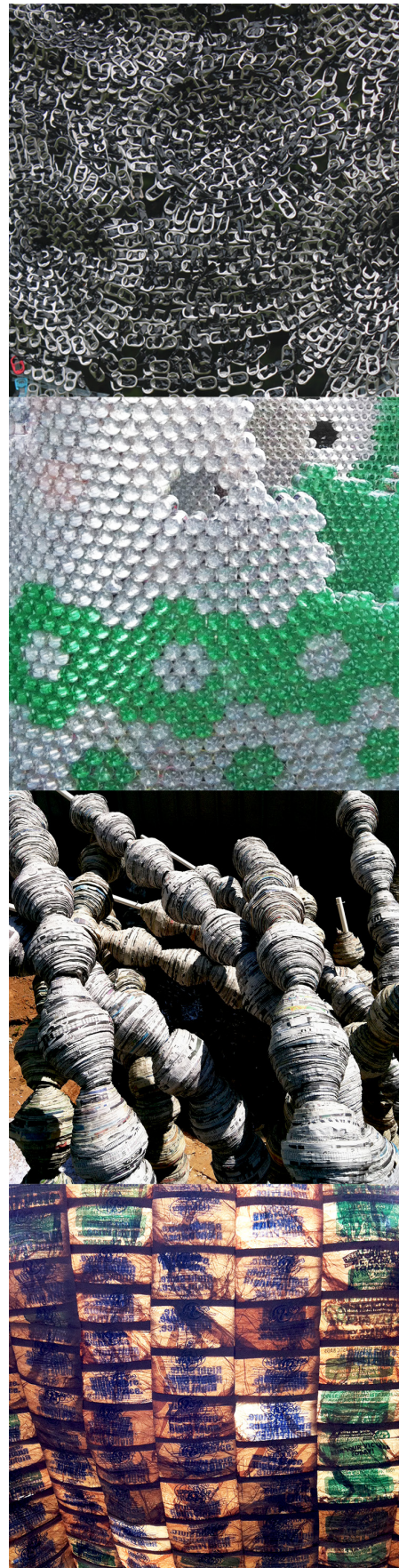
FREE BUILD 2 was an exercise of adhocism. After examining Rude Goldberg Machines and watching Buster Keaton Films, the studio fully relocated to the Milton Airport Hanger. Here, the first task was for each student to construct a 20 square foot workstation using only materials found at the site. Since the site is home to a large supply of construction debris, this project yielded more conventional, desk-like constructions using the scraps of common wood and metal products.

These first two exercises were very much situated within the references of the bricolage. The process and outcomes closely reflect Schwitters's MERZbau, yielding collage driven methods of construction and material transformation. This was partially a resultant of the progressing skill level of the student, as most were unfamiliar or uncomfortable with the tools required for more sophisticated methods of assembly, but also largely a resultant of how the assignments were framed. FREE BUILD 1 and 2 were relics. They were positioned to recall the historical lineage of the found, repurposed object.

FREE BUILD 3 established a critical split from the historical dependence on the collage or the ready-made. In this project the studio moved in the direction of the contemporary fascination with the everyday object as a subsystem or building unit. The focus became the condition of the tectonic rather than that of the composition. "Tectonic becomes the art of joining." This then "indicates tectonic as assemblage not only of building parts but also objects."¹¹ Armed with massive supplies of detritus, the students began a series of operations that fixated on the problem of connecting multiple "units" together in order to form a singular system.

FREE BUILD 3 was an exercise of tectonic prototyping. With this project, teams of 2-3 students were formed. Each team studied, in full-scale, assemblage techniques for transforming a collected waste material into a tectonic element. There were five teams and five tectonic elements that informed the prototype: structure, membrane, roof, screen or wall. FREE BUILD 3 allowed for precise focus on the joint and from the joint emerged a strategy of expansion or propagation of the material unit. At the conclusion of this stage the student teams where to have a successful, full-scale mock-up of the trash tectonic element. The size of the mock-up fluctuated with the scale of material, but the goal was to have a material system with minimum dimensions of 4 feet by 8 feet.

FREE BUILD 4 was the final exercise of the 2013 Trash Tectonics studio. After developing a successful mock-up, each team expanded their tectonic element to become a spatial environment. The final artifact of the studio



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Figure 4: A completed Upcycled Hut constructed from discarded wood pallets, construction debris and vinyl records. Student Team: Clinton Lees, Rebecca Hightower and Karleen Fajardo

was an Upcycled Hut that was the resultant of thirty days of waste collection and assemblage. This Upcycled Hut was conceived as an ever-expanding construction system. The resulting size and form is a reflection of the available waste stream and the efficiency of the construction methods. FREE BUILD 4 was a race. Who can build the largest? Who can build the strongest? Who can build with the most precision? Who can build the least expensive?

After three months of secluded experimentations a jury of architectural critics were bused out to the Virginia countryside to discuss the transformations in trash. The format and process of the studio encouraged discussions that evaluated the system of construction and transformation tactics rather than the meaning or function of the resulting "artifact". The artifact was a manifestation of the success or short-comings of the system. The largest structure, constructed from construction debris and vinyl records, developed a very efficient method of repurposing and assemblage, whereas the most precise structure, made of a delicate weaving of aluminum pop-tabs and VHS tape, lacked scale but gained momentum from meticulousness and ambiguity of form. The review acted as an evaluation and celebration of process.

The resultant of this three-month investigation in the transformation of waste was a prototype of upcycled construction. The research revealed that in order to work with this type of material the designer must take a proactive role in construction and material acquisition. This is a role that extends beyond the computer screen; a role that requires the designer to get their hands dirty. A

great amount of energy and time must be devoted to material collection and preparation. While this is initially a major detractor for working with salvaged resources, the investment can be minimized if collection is an integrated component to design and construction. One team experimenting with newspaper turned collection and processing into a performance that aided in articulating the constructed form. Another team collecting aluminum can pop-tabs found fraternity and sorority houses to be sites of excessive beverage consumption by means of the aluminum can and employed the social institutions as collection agencies.

PEDAGOGY

The Trash Tectonics studio was initiated with two objectives. The first was defined by the ecological mandate. The goal was to prompt a line of design thinking that intuitively scans the local context for material possibilities. In a world that is facing drastic ecological and economical tensions, one alleviation concerns waste. If we can transform how we approach making things so that construction becomes a method for eliminating waste rather than producing it, architecture can be part of a solution.

The second goal for this study was related to the educational pedagogy of the Bauhaus and the tradition of craft. The methodology of the Trash Tectonic Studio emphasized construction and making by hand. It took manufactured products and repositioned them as building blocks. The most effective means for thoroughly testing this approach is by full-scale material operations. After initial research, participants spent 90% of their time in the field collecting and constructing. Conditions of craft were challenged because of the complications in working with waste material. The most successful projects were those that were able to obtain full mastery of material and assembly so that the discussion moved beyond the material and into the spatial and performative attributes of the tectonic system.

The first day of studio was dedicated to watching *Manufactured Landscapes*; Jennifer Baichwal's documentary on Ed Burtynsky's dystopian photographic portrayal of China's manufacturing conditions. By the end of the semester students were acting out these images of mass-production. The process was extremely hands-on, repetitive, and labor intensive. The students of Trash Tectonics were confronted with the economies of labor. The agenda encouraged a systems approach, which in-turn produced a significant amount of repetitive tasks involved in material preparation and construction. Yet, success was discovered by embracing monotonous repetition. The teams that acquired the greatest amount of triumph are also the teams that defined and endured an efficient, repetitive process. The studio was a lesson in the sustainability of labor and measured value or success based on an analysis of input effort relative to output effect.

FUTURE OBJECTIVES

The Trash Tectonics studio has endured one year of experiments. The aim is to continue the research for two more years in a studio format. The future studios of Trash Tectonics will build on the concepts and methods developed in this first installment, however the hope is to now begin looking at waste from the front end. The next studio will begin by designing an object for mass consumption rather than finding one. Embedded in this object will



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Figure 5: A completed Upcycled Hut constructed from 30 days of newspaper waste. Student Team: Alex Picciano and Nancy Cronauer

be an architectural after-life. It is a “Cradle to Cradle” approach that redefines the scope of a design project. In this studio students will begin by examining an object and an architectural tectonic element simultaneously. The resultant will be the development of an adaptive object that has an inherent logic for transformation. Shifting to the front end of upcycling will alter the specifics of the full-scale design pedagogy and focus energies on the ecological mandate of the studio rather than fixating on scavenging. The constructions may not be as ambitious in scale, but full-scale prototyping will remain fundamental to the process of investigation.

Designing functional transformation into an object has the potential to allow this research to scale up beyond the mode of material study or installation. Scripting a second life into products and packaging could lead to real architectural applications. In 1963 Alfred Heineken experimented with this notion as he developed the WOBO (world bottle) with Dutch architect John Habraken. The WOBO was a Heineken beer bottle with textured flat sides that doubled

as a brick. "Heineken's idea came after a visit to the Caribbean where he saw two problems: beaches littered with bottles and a lack of affordable building materials."¹² A similar approach was taken by Kengo Kuma for a prototype entitled Water Branch House, developed for the Museum of Modern Art's Home Delivery exhibition in 2008. Kuma's team designed modular water tank out of PET that has ability to stack and form a wall system.

Regardless if it is object design or object re-appropriation, the Trash Tectonics studio will continue investigating the after-life of everyday products and materials. The research and work is an analysis and critique of the material excess that exists in a consumer driven culture. However, the aim is not to construct idealistic mandates to reduce waste by the means of changing habits, rather we aspire to exploit waste for architectural production. With this agenda, waste is a valuable resource that awaits transformation.

ENDNOTES

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