Repurposed Political Ply

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This paper describes a building envelope that has been formed from recycled political campaign boards. It explores its formation as a deviation from one cycle of production and consumption (manufacture, implementation, removal and disposal of the campaign board) to another i.e. a re-purposed shade canopy.

This reformation is explored through the board’s physical properties that are adapted to form individual cellular units by using lamination techniques (cross grain and mechanical fixings at stress points) and developable surface manipulation.

The paper then describes various stages wherein digital design and fabrication provided methods to achieve the reformation. It demonstrates how initial discussions about the cellular geodesic structure were re-interpreted through the constraints of the material as parametric limits (structural performance, elastic limits, load points etc.) along with a reduction waste during cutting (estimated at 30%).

The project is then described through elements that foster dynamic interaction between the user and the surface i.e. evaporative cooling and heat stress sanctuaries in outdoor spaces. Furthermore the method of repurposing is then applied to other elements that provide the evaporative cooling system, timber glulam legs and sand bag feet. Together these element help create a microclimate within which gathering may occur to mitigating heat stress in hot arid climates.
Repurposed Political Ply

“It (David Greene’s intention) argues that if we really understood the implication of a networked world, saturated with millions of useful gadgets, we might find that we are surrounded by countless possible architectural propositions”.

The seasonal nature of American politics provides an episodic abundance of these 5/32” corrugated polypropylene 8’x4’ sheets. Street corners and intersections play host to the periodic blooming of heraldic photographs, primary colors, slogans and all the paraphernalia of a campaign season. When the season is over they are removed, chipped and sent to landfill sites. What follows is a description of how this material can be re-purposed for architectural uses as a performative skin.

• In the experience of microenvironments and via the embedded computer.

The first may be described as “formative” and the second “embedded”.

These twin concerns offer a zone of negotiation that lies at the center of discussions on digital design in architecture and which often represents quite different poles. In this case of the formative fabrication and RP represents a new version of ideas about flexibility in that the end of functionalist spatial flexibility and mobile architecture has given rise to a design stage flexibility of pre-production permutations. In effect flexibility has been moved up the design chain and is now embodied in terms like mass-customization and “delayed differentiation”

This might be countered on the other hand by Paskian notions of the role of cybernetic structures of architecture wherein the most contemporary technology plays an ongoing role in activating the user. In this case the embedded computer implies a long-term relationship between the digital and architecture. Here both architecture and the computer form a symbiotic relationship while the formative interpretation suggests a high front-end engagement after which the computer is largely discarded once the building is complete. By contrast the embedded computer might suggest a different kind of modernist flexibility within architecture albeit under the term “adaptive” or “responsive”.

Transitionary design processes.

The nature of this dichotomy was central to the preliminary design discussions on the fabrication of an Earth Day festival shade canopy for ASU Polytechnic campus and subsequent exhibit at Nelson Fine Arts Gallery “Art and Sustainability” exhibition. The project was designed and constructed in collaboration with ASU’s SALA undergraduate senior students and GIOS environmental engineers. Our digital concerns where projected upon a program, which required an active solution to temporary shade in a hot and arid climate. Central to these concerns are:

• New consideration about the design life of materials.

Figure 01 Underbelly of The “Political Ply” shade structure.

This project will be described from two perspectives

• In the physical sense of its material and fabrication.

• In the experience of microenvironments and via the embedded computer.
• How collaging and re-purposing changed notions of architectural language.
• How active participation in the change in state of water and evaporative cooling affected notions of the user.

While both the first and second points turned out to apply more to the notion of formative digital processes the third featured more heavily under the notion of embeddedness.

Formative design process

The role of this building was a relatively straightforward requirement to provide shade in the form of an easily assembled temporary structure (an alternative to the “easy up”). However the design discussions where suffused with a persistent environmental slant in that not only was the event to be a celebration of Earth Day but its focus was upon locally grown organic food. In the design process both issues of design life and architectural language were at the forefront of the design process. For a long time the project concentrated on a purely geodesic solution in the traditional sense that it provided an achievable temporary structure based on existing precedents. However ideas about how the project improved a typical geodesic structure were not resolved until we arrived at a material that prompted a design life discussion. Pressing issues of material cost eventually produced the ideal material of reusable plastic political campaign boards. Prolonging the design life of these boards moved the project into its final form and into production. (While there was some discussion about the legacy of “Drop City” it was felt that the contemporary nature of the material and its fabrication process would provide enough development). The appropriateness of this material was partially due to a kind of coincidental temporariness i.e. political billboards have a similarly temporary/episodic existence in the same way that they are lightweight, weatherproof and cheap. Additionally we liked the way that the boards heraldic graphics could be aesthetically re-phased. In revamping this material both the language and workings of material lifespan issues came right to the fore.

Figure 02 Repurposing of political campaign boards.

It this stage the digital design and fabrication processes provided methods by which the material could be reformed into a shade structure. Initial discussions about the cellular geodesic structure where re-interpreted through this material. Cellular components designed in 3D as a hexagonal cellular dome where the applied to the twin walled plastic sheet. Each cell was formed into a continuous strip as an unrolled developable surface via a Rhino model. Each strip could be folded into a rigid cell and braced with an infill panel with an open center to reduce weight and improve structural rigidity. Further rigidity was generated by laminating two layers of sheet with each fluted section running at right angles to one another in a similar way to the grain orientation of timber ply. Each unfolded strip would be Rhinonested within the 8x4 plastic board to reduce waste as far as possible (estimated at 30%).

Figure 03 Unfolded permutations of cellular units.

This quality of the tessellations also informed the stacking of the individual cells and was key to solving the stacking and storage issues of the project. Both issues were resolved digitally. However the additional and perhaps
most important part of the digital design process lay in the analysis of the hexagonal grid of cells that formed the geodesic dome which were initially assumed to be repetitive. Our Rhino analysis of the dome form undid this assumption (the closest repetitive variant being the Bucky Ball where the cells were too large) and led to a dome geometry formed from four different cell types each with their own particular geometry. These could be easily formed from mass customized pieces under the provision that their difference was not so great that they would exceed the tolerances of the stacking tessellations.

This digital formation process also contributed to the design of the glulam legs again under the condition that we focused on material expediency i.e. we attempted to avoid profligate CNC cutting patterns. Here we restricted ourselves to 2x1/4 ” unit timber strip based on a study of its bend tolerances and nature of its developable surface as individual layers in a glulam structure. In both this and the cell unit the “unrolldeursrf” Rhino command played an important roll in the physical transformation from flat stock to formed final element. In the case of the cellular dome however the digital transformation process also added to the sense of transformation of a material from one use to another that lay outside its original purpose.

While these functional benefits can be reasoned empirically it could not explain the way in which the project was aesthetically transformative. In a sense this became the most significant motivation. When one team member suggested that we turn the images of Fulton Brock and his family inwards so the structure would be the predominantly white rear faces of the board the suggestion was roundly rejected by all. In this sense what the team responded to was the quality of collage as transformation of meaning by juxtaposition. A subtext of the fabrication process became a quasi Photoshop-like Exquisite Corpse⁸⁸ game wherein the image of the political campaign language was used to undermine its authority. Stacking the cells also became some kind of Bretonian game as well where in the vertical permutations could reveal a composition of disconnected body parts similar to a Hans Belmer composition.

Figure 04 Fulton Brock and Family Exquisite Corpse from Campaign boards.

Embedded Computers

Figure 05 Elements and procedure in repurposing the Voss bottle.

This notion of re-purposing of the conventional object offers a segue into digital fabrication’s corollary of the embedded computer/responsive environment. In this case the re-purposed object is the plastic Voss bottle. In considering the environmental aspects of the project the team felt that it should respond directly to the use and interaction with existing environmental context (in this case hot and arid). Our aim was to provide an active cooling mechanism that in turn could activate users in a haptic dialogue with the project. In this respect we turned our attention to the prognosis of the fluid dynamic qualities of the space by adopting heat stress analysis⁸⁹ as a means to provide a heat stress sanctuary below the canopy. The Voss bottle was now re-purposed into a
personalized mister that could be pressurized via bicycle pump with reused tire valves and misting heads. This bottle is then manually pumped by visitors and hooked into the hexagonal cell. Each Voss bottle mister then soaks the inner surface of the cells shade canvass to produce a wicking effect that provides a radiant and evaporative source of thermal comfort to the visitors below (direct misters are considered to be potentially unhealthy as particulated water carries pathogens that can gather in misting heads). This effect was used to counter the high values of heat stress that are a common experience in environment we are working in. (Heat stress is described as “Temperature Index (WBGT): a weighted average of three temperatures -Dry bulb (DB)– shielded from direct sun light- Natural wet bulb temperature (NWB)–exposed wet bulb sensor-Globe temperature (G)—temperature inside a hollow metal sphere where \( \text{WBGT} = 0.7\text{NWB} + 0.2\text{G} + 0.1\text{DB} \))

However while these simulations represent one use of the computer within architecture it does not engage it in the sense of the responsive environment. With this in mind we turned our attention to the manner in which the projects research component could become an ongoing information loop within the design. This aspect of the project offers a means of incorporating the heat stress sensor within the structure in a way that would convey the changing contours of heat stress index on the fly. Here the information relay is intended to work via a wireless connection to a webpage from which heat stress information can be accessed. Here we also envision making this information available to Haque Research Pachube i.e. “A web service that enables people to tag and share real time sensor data from objects, devices and spaces around the world, facilitating interaction between remote environments, both physical and virtual”. This information relay system can only be partially described as responsive in that the user is not digitally engaged in the activation process i.e. the activation process is a manual interaction whereby the bottle is pumped up and clipped on. The users participation is probably more digitally passive in that he/she receives information digitally and can respond by seeking out thermal comfort zones.

The motivation for such ambitions (as Haque describes it) is to make the physical actualities of the built environment analogous to the adaptive nature of the free libre open source software (FLOSS) wherein users can adapt, improve and pass on components of the built environment. Here the analogy is crucial to the translation of ideas about software into physical form while both sharing the aim of overcoming the immutable structures of current architectural production. Both the Voss bottle and the re-used plastic campaign board are both “usable artifact” partially achieves this aim. The relay of environmental information on the other hand returns the project to the realm of software in a more traditional mode of gathering and presenting information. Further permutations of this project would seek to make this process a two-way relationship where users might use environmental information to adjust the cooling performance.

Conclusion

In this text I have offered a demonstration of a two-pronged approach to the deployment of digital procedure
within architecture. I have suggested that this can be characterized by considering the digital as either a formative design process or a manifestation of embeddedness. The project that was used to convey these concerns incorporates both in incomplete forms in a way that suggest that they are coupled and co-exist.

Together these aspects of the Political Ply structure create a new, temporary space for gathering. In this way the material has produced a low cost solution to a persistent problem of shade in the American Southwest. It demonstrates how contemporary forming processes can be adopted to make a demountable solution to temporary shade. This formation considers both the structural issues of the material and its stacking arrangement between uses and locations. It also explores how this formation process results in an aesthetic that helps to promote the importance of repurposing materials to its users. The project considers how other materials can be similarly repurposed to provide further structure and to provide a manually operated cooling system.

As a consequence this structure has been deployed at several different events since it was built in the spring of 2009. These events have included student end of year gatherings, art events, the EPA 2009 Expo in Washington and its current role as a shaded outdoor space on the ASU Tempe Campus in Arizona (it was also select for two design awards). Its formal and aesthetic qualities draw people together and help prolong gathering via the cooled underbelly and misting system.

References


iii See both Situated Technologies and Hague Research.

Situated Technologies, a project by Omar Khan, Trebor Scholz, and Mark Shepard, is a co-production of the Center for Virtual Architecture, The Institute for Distributed Creativity (IDC), and the Architectural League of New York. http://www.situatedtechnologies.net/

Haque Design + Research specialises in the design and research of interactive architecture systems. Architecture is no longer considered something static and immutable; instead it is seen as dynamic, responsive and conversant. Our projects explore some of this territory. http://www.haque.co.uk

iv See http://students.asu.edu/discovery/feastival


vii Bill Massie describes use of PVC piping as American bamboo then we describe this as Political Ply.


ix Work done in collaboration with Joby Carlton Asst Research Technolgst (FSC), Institute Of Sustainability and GIOS environmental engineering students.

x See “Application of “cool canopy” for outdoor thermal comfort”. Harvey Bryan, Ph.D. Shivani Shah, Rashmi Sonal
AMS_Joby Carlson_Permeable Parking Lot Heat Stress Monitoring. GIOS ASU

Heat Stress index- Joby Carlson

Pachube -. See http://www.haque.co.uk/

Matthew Fuller and Usman Haque – Urban Versioning Systems – Architectural League of New York Situated Technologies Pamphlets 02

Ibid

First Place in 2009 AA Fabrication Awards and S. EPA and AIA Lifecycle Building Challenge 2009 Award of Honorable Mention EPA