Emergent Practices in Flux:
Design Build; Digital Fabrication and the Mutable Interior Environment

Introduction:

The relationship between the imagining of ideas and the building of ideas is the margin from which this exploration springs. Design build and fine arts installation are well established within the disciplines of architecture and art, but how do these practices situate themselves within the discipline of Interior Design and Interior Architecture? Can these interrelated disciplines and processes create a feedback loop of material learning from which conventional projects might draw?

Design build is a practice in which design and fabrication processes occur almost simultaneously and are often undertaken by the same persons or team. Installation can be seen as a temporary version of this process. What are the emerging questions contingent with practicing direct fabrication and making processes, in the realm of interior architecture? The process of making is one that is fraught with changes and new beginnings and endings. Design-build in architecture around small scale installation projects has become a way of experimenting with new ways of making that larger projects and proscriptive studio processes have not fully given opportunity for exploration. (Badanes, 2009) In this way of operating, the way interior space is perceived can become very dependent on surfaces and the way those surfaces might create interior volume.

Professional practice is often as follows: schematic design, design-development, construction documentation and construction administration. (Demkin, 2008) Design / build practice is one in which the design and build parts of the process can overlap with the documentation as if they are happening almost simultaneously. (Beard et. al, 2001) In the design / build process because of the shortened time frame, designers are engaged in a process of learning by making. This can create a possibility for much materials exploration in the design process and in the final result. This reality differs from the usual studio process in that the implementation of the project causes designers to fully question their assumptions about the design and the materials as the project takes shape. (Wilkinson, 2007) In questioning the elements of the project as they become real, one must experiment and this experimentation leads to the inherent value of such projects for breaking new ground as test laboratories for more conventionally run processes. Some are theorizing that design practices are returning to a pre-industrialized state in which customization is increasingly the way to achieve efficiency in design. (Klinger, 2008)

“Design Intelligence”:

An example of design build as a petri dish of discovery can be found by looking to such precedents as SHoP Architects’ PS 1 Dunescape Installation in 2001. As we can see with this project, design/ build is often spurred on by other constraints and requirements. These constraints can either be universal or specific to the project at hand. In the case of the PS1 project the goal here was to build an urban place with

water that provided a social space for city residents. Temporary in nature, the PS1 installation lasts for the summer and the project is chosen by jury.

"The Young Architects Program at MoMA and MoMA PS1 has been committed to offering emerging architectural talent the opportunity to design and present innovative projects, challenging each year's winners to develop creative designs for a temporary, outdoor installation at MoMA PS1 that provides shade, seating, and water." (MoMA, 2012) This project was a landmark in the competition, it was extremely popular, but the method of fabrication was geared to meet the challenge. Most notable the cost limit of the project which was $50,000.00 and also the time constraint for fabrication which was 6 weeks. The project had to be designed so that almost anyone could install it. SHoP's approach was to combine program, structure and skin in one sectional profile that varied over the length of the project. Employing 2" x 2" pieces of cedar wood, the sections were built and then agglomerated to make the form. Employing full scale modeling, prototyping and templates instead of construction documentation, this project is an example of how installation art, design build and fabrication can intersect to create new kinds of projects and spaces. (Klinger, 2008) The simple, changing sections of wood frames created an extremely complex set of possibilities in terms of the way people could interact with the project. This is another way that these projects often approach complexity through a simple repetitive move repeated and adjusted to create a complex outcome. Michael Speaks calls this "Design Intelligence" in which one gains awareness from making; this blurs the previous boundaries that existed between design and fabrication. (Speaks, 2001)

Digital Fabrication and the Interior:

Within the realm of digital fabrication, there are multiple acknowledged basic modes of operation. Almost all fabrication processes are related to or arise from one or more of these modes or processes. In the recent book "Contemporary Digital architecture, Design and Techniques", the author breaks fabrication down via the modes of tool production used for the outputs, these are simplified into *Cutting* using a CNC router or laser cutter to cut two dimensional sheet goods; *Subtractive fabrication*, involving the removal of material in 3 dimensions either involving chemicals or machinery most commonly the carving accomplished by a milling tool; and *Additive fabrication*, involving the "building" of component through the adding of layers as produced by a 3d printer. (Kottas, 2011) In her seminal small book on the topic "Digital Fabrications: Architectural and Material Techniques" Lisa Iwamoto categorizes the works the following way: *Sectioning, Tessellating, Folding, Contouring* and *Forming*. (Iwamoto, 2009) All of these categories in some way relate to the way that the works have been produced or made with the machines available.

A project that uses folding for example will employ parametrics to determine the relationship between form and material, in such a way that the form can be flattened for cutting on a router. A project that involves contouring might involve parametrics to generate the tool paths for the machine that will rout the material. Each process is has its own set of criteria, constraints and challenges based on the methods of fabrication. Beginning in February 2011, the warp_wrap project was a challenge to engage digital methods in interior spaces and to create a project that engages the standard interior space in such a way as to engage the user with new interior components other than wall, floor and structure. This project was incited to create a prototype for a digitally fabricated interior wall system. The project to date has allowed exploration into current research and work being created through both parametric and digital methods of fabrication. Using the techniques identified through this study, development of the project will continue. In considering

these modes of operating and material strategies, a most basic form was considered, the waffle structure. A waffle structure is a fabrication method that arises from the cross sectioning of a form in two dimensions. This way of working involves cutting as the main fabrication method and sectioning as the main mode of operation. In studying the different possible ways of approaching interior digital fabrication and design build, it soon became clear that the projects were very much determined by the gap between what could be produced digitally and the reality and constraints of various materials. In the waffle structure, a major driver of the parametric model is the material thickness. In fact, the width of the slots used to attach the pieces together, are parametrically driven by that thickness. The engineering of a definition in grasshopper was undertaken that would allow for the adjustment of the thickness based on different material desires. The process followed to create the warp_wrap prototype was as follows: Create a generic interior condition; in this case the author selected the storefront window as a possible area of study. (Figure 1) Build a surface that divides or enhances the interior space. Using the contour tools in Rhino, create horizontal and vertical sections that would slot together to make this. At this point the author made a small manually slotted prototype in order to test the process. (Figure 2) The contours were studied from different angles and cut in different ways to understand how the contours were affected by the shape of the surface. The next step was to create a model parametrically so that the large amount of components could be customized simply by adjusting a few parameters.

In design today, parametric modeling and digital fabrication are the current modes of operation for many design disciplines. Parametrics allow one to design using variables that control form universally. This way of thinking is especially well matched to digital fabrication, in which variables such as material thickness and size can determine the properties of form as it is machined from digital files. Parametrics deal with variables and aspects of form that range from simple to complex. In order to learn more about parametrics, the author took a two day seminar with Ronnie Parsons and Gil Akos, of **Studio Mode [ ] | modeLab** , a Brooklyn-based design studio and research collective. Their practice is committed to design as a form of applied research, and they engage in practices that are linked to ideas about material research in particular. (Studio Mode [ ] | modeLab, 2012) Parametric design is the medium through which they explore any number of systemic design practices and interests. In the seminar, parametric skins and basic parametric processes were examined. The result was that the author was able to create a digital file in which material thickness could be re-defined and the slotted connectors would automatically update on the model. (Figure 3)

Having produced small scale prototypes, technology leads manufacturing and design to become tandem processes; in this way, the practice of design-build becomes more current to the world of interior design. If the methods of fabrication employed to create and alter space and its components become more reliant on the designer as maker and operator, (Klinger, 2008) how does this change the way interior spaces are viewed, or used? Could users themselves begin to take authorship of their spaces in new ways? Does it create a fresh kind of interior occupancy? On examination current practitioners in this realm are operating to close the gap between the design and fabrication processes. The goal is for simultaneity of process in order to extend the control of the designer. Constrained and parametric design is a part of this current directive.(Iwamoto, 2010) The opportunities of digital processes and fabrication within creative design build explorations; and the application of digital methods to the design process can be seen as a way of developing an approach for interior space and function that changes our conception of what interiors practice is. The next step in the process for warp_wrap was full scale prototyping. Before this could occur

however the model needed to be revisited and adjusted based on the previous experiences. In this process, the author produced several prototypical studies from various media, and in various stages of completion. (Figure 4) In tandem to this process, the author trained on the 3 axis CNC router in order to produce the necessary tool-paths to guide the router to cut the material. This training on digital fabrication equipment occurred at NextFab studios in Philadelphia, a digital fabrication lab that has extensive resources for this type of work. The machine there was built and is maintained by Lewis Colburn an artist and technician with extensive knowledge of parametric modeling, and fabrication. Lewis collaborated with the author to produce the grasshopper definition that was used to fabricate a wood full scale prototype from ½" Plywood. (Figure 5,6)

The processes here are often written and presented in terms of their meaning for architecture. Often however, the projects used to illustrate this way of working are purely interior in nature. The question asked through the Warp_wrap exploration becomes how these types of project can become more than simply decorative. Is this new interior element useful as well as experiential? How does the interior environment become determined by this new way of thinking about process and production? A project is often designed around the idea that the walls and ceiling were containing the space. Now within interiors practice these new ways of operating are creating novel layers to the interior environment. Often these layers can be simple containers such as the warp_wrap project; a recent issue of Interior Design Magazine contained projects driven by these types of processes. In Interiors, space is often quantified through standard elements, and so the process of understanding these projects that are neither furniture nor architecture becomes difficult. Often as in the recent Kengo Kuma Starbucks, the fabrications are part of the aesthetics of a space. In searching for new ways of making space, this approach might be considered limiting.

Conclusion:

Richard Sennet in his book "The Craftsman" explores a concept he refers to as "being as a thing" he maintains that at a certain point in the process of making, after a definite amount of time, the maker attains a mastery of fabricating and no longer feels a separation between their hand and the act of making (Sennet 2008). Digital fabrication does not seek to replace the hand, but in some ways to create a new set of hands. These processes require no less mastery, but the mastery becomes on of workflow and control. Springing both from practice and pedagogy, there is an opportunity to contemplate ways of making and designing that speak to the idea of mutability within interior spaces. Constraints often lead the way to freedom and in digital fabrication the constraints are often universals such as material thickness and machinery strength and capability. In the interior environment such elements as structure and walls no longer define the relationship between the space and the user, as these digitally fabricated projects now create an additional possible layer of information within interior space.

Notes:
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Studio Mode [ ] | modeLab Website: http://modelab.nu/; Visited February 10 2012
Sennet, R. 2008.*The Craftsman*, Yale University Press: New Haven and London. P. 174-175.

Speaks, Michael. *"Design Intelligence and the New Economy".* Architectural Record; January 2001; P. 72

Figure 1 Early Development (Credit: Author)

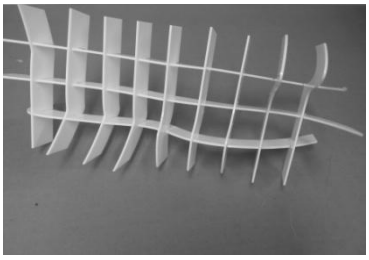

Figure 2 First Prototype (Credit: Author)

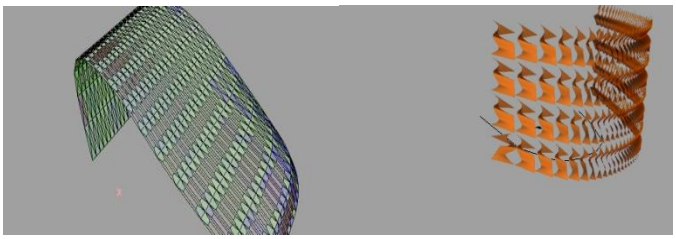

Figure 3 Parametric Training Summer 2011 (Credit: Author)

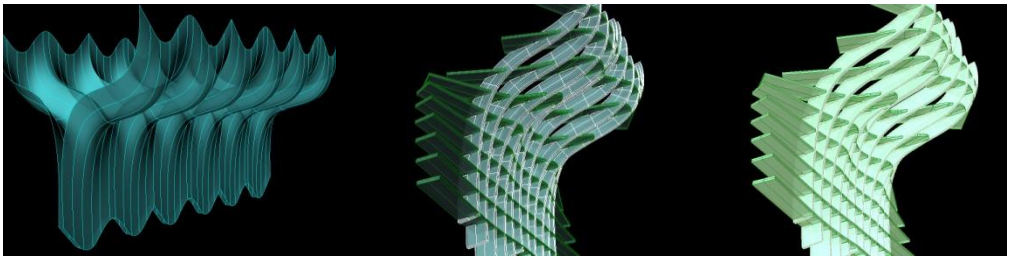

Figure 4 Prototype Development (Credit: Author)

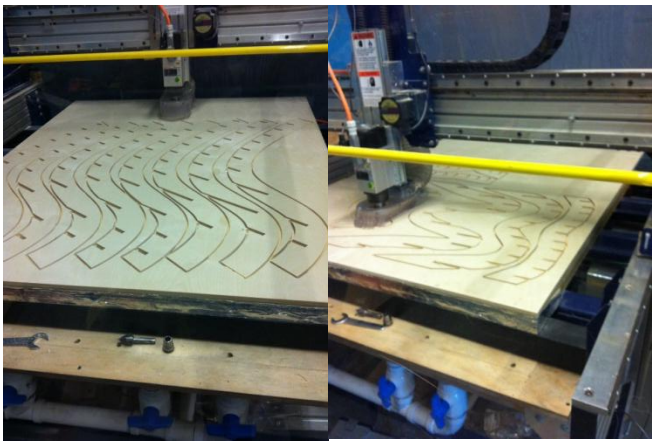

Figure 5 Prototype Development (Credit: Author)