Performative Surfaces and Skins

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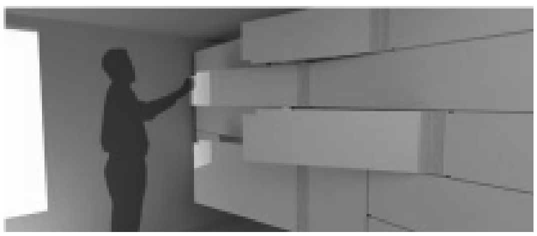

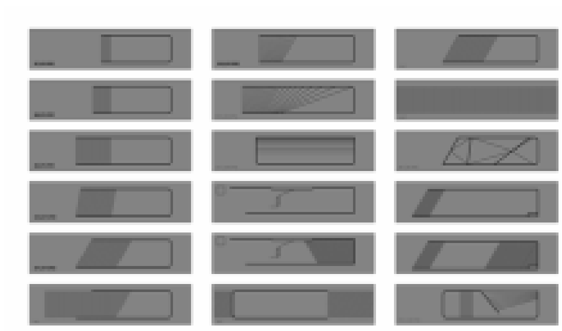

Figure 1. Jean Prouve prefab panel assembly line

Figure 2. General Panel house kit

STANDARDS?

The design and ensuing fabrication of architecture is tied to and influenced by materials and related manufacturing processes. Historically, increased automation prompted standardization in these areas and severed traditional working relationships between architect and craftsman. There were some notable exceptions in which architects sought to exert control over manufacturing. This is prob- ably best exemplified in the practice of Jean Prouve[1] in which, for a span of time, studio and factory effectively merged [figure 1] or the prefabricated panel house col- laborations of Walter Gropius and Konrad Waschmann [figure 2] where design of process paralleled product.[2] Both utopian pursuits ended in failure as the qualitative demands of the architect met the quantitative and eco- nomic demands of mass production in which standards increasingly catered to the lowest common denominator. Many of these standards evolved from time-tested systems in which significant set-up and tooling costs were mitigated by high productivity and increased volume. A manufacturer's produce a finite product. In most instances, these rigid manufacturing processes limited material and product variation, resulting in increasingly narrow choices for consumers to draw upon. Typically, deviation from these standards became increasingly prohibitive due to cost and time. For architects, this resulted in a dilemma in which, the particular and often unique necessities of a design project had to be addressed with a narrow palate of standardized products targeting broad audiences and necessities.

"We used to live in an era in which most things had to be made to be the same, but we are about to enter a new era where, if we want it many things or perhaps all things can be different." [3]

In contrast to the past, today's are increasingly elastic and prompt considerations for the possibilities beyond mass production. Manufacturing tools can be utilized for what they perform, not necessarily what they produce, redefining the traditional notion of a Fordist assembly line.4 Recent architectural projects illustrate such technological advances in which digitally driven equipment enable modes of production where soft- ware and hardware provide the medium for collaboration between architect and manufacturer.[5] Here, typical conventions of information exchange found within practice evolve as design document becomes a literal set of digital manufacturing instructions, providing a virtual extension of the hand of the architect into the fabrication process.[6] The translation is not seamless, requiring a familiarity with emerging techniques and a willing collaborator. This does, however, increasingly present the potential for customization, variation and standardization to co-exist. Ironically, the equipment that limited production variation and manufacturer - architect collaboration has evolved to a level of agility that reintroduces the very features it marginalized.

PROCESS

Plywood and Medium Density Fiber Board are affordable, widely available building materials utilized by the construction and furniture industry alike. Although they are quite similar dimensionally, their structural, aesthetic and machining attributes vary significantly. These two off-the-shelf materials provided a palate for the investigation of digital fabrication techniques; specifically 2-1/2 axis computer numeric controlled routing (CNC) in which two-dimensional vector CAD drawings determined tool paths.[figure 3] Process and product shared importance and provided opportunities to test how one moves from digital model to physical artifact while encouraging speculations on alternative implementations of both materials. To begin with, functional associations with architectural conventions were loosely defined as interior wall surfaces. The generality of context fostered unpredicted results, while providing a basic frame of reference. The general premise was to allow for the product to evolve through material specific process investigations. It was not however, merely the result of technique. Form responded to, not followed, process. As research ensued, functional opportunities emerged. A reciprocal relationship between process and product emerged in which action on a material adjusted in response to refined goals. Together, the MDF and plywood investigations sought to produce surfaces that could respond to changing programmatic or environmental requirements of a given space, either through material mutability or built-in flexibility for future adjustment.

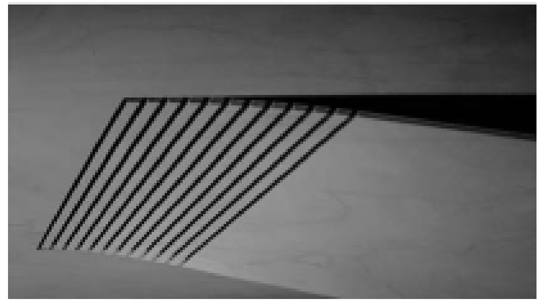

Figure 3. Machining Tool Paths

PERFORMANCE

Generally, performance has had two distinct definitions, the effectiveness of something to fulfill its intended purpose or the execution of a series of actions. The architectural virtues of firmness, commodity and delight defined by Vitruvius point towards to the former and continue to represent a common interpretation of performance relative to architecture in which efficiencies rather than actions are the qualifying criteria.[7] Although buildings are often a stage for performance, they rarely become the object of performance. One can consider an alternate, less static definition in which performance can be seen as a dynamic responsiveness to various complex relations.[8]

This suggests the potential for an architecture that is agile and capable of multiple identities, resulting in a form of detached determinism in which change primarily occurs within pre-defined limits. For the MDF and plywood investigations, these limits were largely dictated by the material itself, such as its dimension and strength. Although this is related to how the materials were machined and fabricated, the limits do not necessarily prevent accidental or intentional mis-use. They are more guide than barrier.

Performance relative to this investigation can be considered as both effectiveness and action, whereby the action of the panels is reliant upon the body. In the case of the plywood panels, action becomes bending. [figure 4] The operation of the panels is facilitated through the milling of visual clues into to the panels, informing the user as to their operation. [figure 5] The amount of action upon the panels is determined by the user. Here, performance becomes participatory as panels are adjusted to achieve a desired effect.

Figure 4. Bending Kerfs

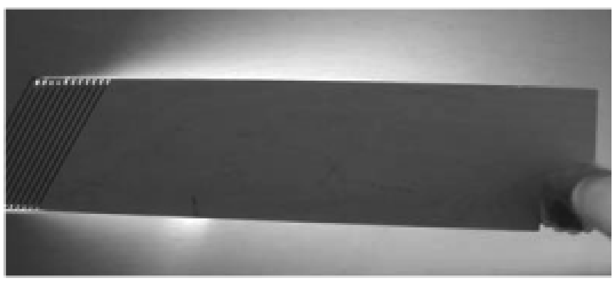

Figure 5. Finger pull on plywood panel

Figure 6. Partition of Plywood panels

PRODUCT

Both branches of research, related to Plywood and MDF occurred in tandem. Although similar techniques were employed, intrinsic differences between the materials led to quite different results. In the case of plywood, 7 ply Baltic Birch was cho-

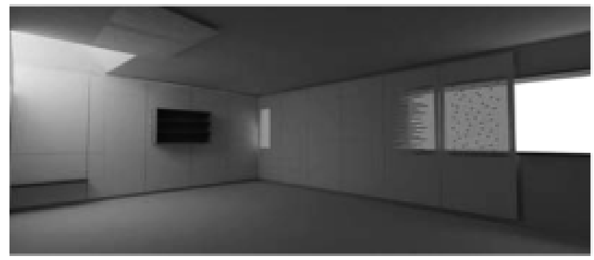

Figure 7. Open light diffusing plywood panel

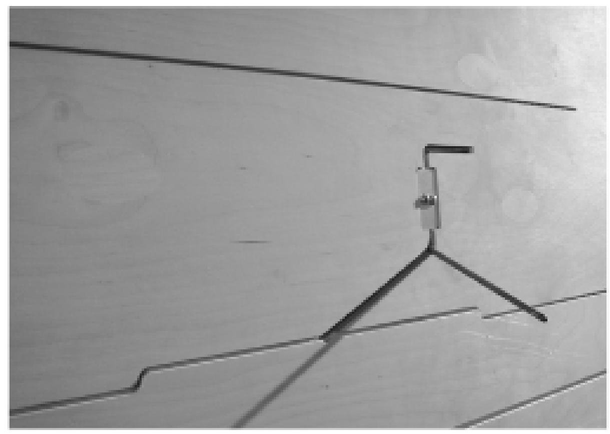

Figure 8. Indexing Hardware

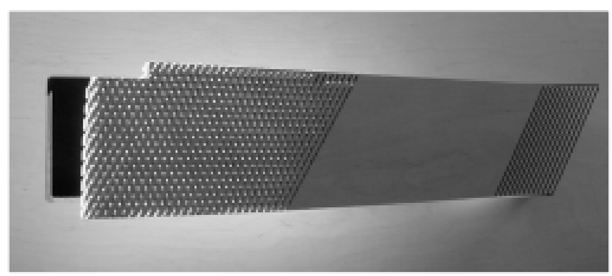

Figure 9. Double-sided light screen

sen for strength and finish quality. Initial routing was primarily 2-dimensional, producing kerfs and cuts which allowed bending in response to push and pull, effectively transforming a rigid sheet into a pliable surface. [figure 6] A subtle change in the depth or spacing of kerfs dramatically affected ease of bending and general stability. Milling too deep resulted in precarious sheets that were easily broken. Milling to shallow effectively left sheet rigidity unchanged. Additionally, it became clear that locating the bending element as a figure within or

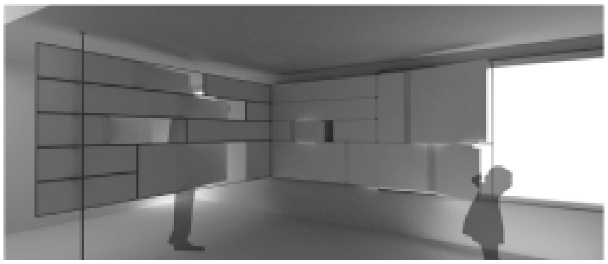

Figure 10a. Plywood Panels Open

Figure 10b. Plywood Panels Closed

Figure 11. Engraved MDF panels with integral light screens

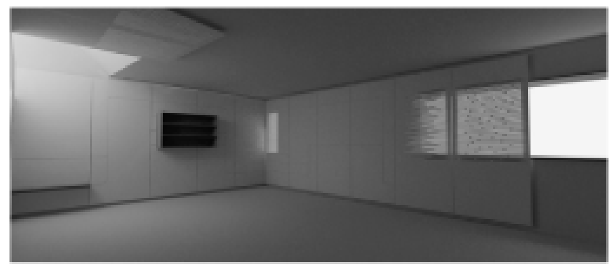

Figure 12. Engraved MDF panels with furniture elements

extension of a larger sheet, provided area for mounting.[figure 7] As these investigations progressed, milling moved to both faces of the plywood sheet. Here, the registration and intentional mis-registration between cuts on both faces provided tabs for hardware, which held panels open or closed [figure 8], while in the instance of multiple superimposed cuts of opposing angles, offered a lattice like condition.[figure 9] At the scale of a room, a series of operable panels encourage a modulation of view and light through adjustments of the surface by inhabitants. The panels can be installed on top of existing walls or glazing, effectively re-skinning it, or as free-standing partitions. In both scenarios, plywood panels are attached to a steel frame, providing structural rigidity while allowing for pan- els to be held off of ceiling and floor. Depending upon the number of bendable panels installed, the ratio of bendable surface to fixed surface and the degree of opened or closed panels, the ability for the surface to bracket view and light change significantly. [figures 10a,b]

Due to its fiber size and lack of grain, many of the outcomes of the plywood inquiry, such as pliability and translucency are unachievable with MDF. The homogeneity and strength of Medium Density Fiber board offered milling consistency throughout its section while allowing for relatively simple surface finishing. Here, the sheet contains multiple types of cuts, resulting in a vocabulary of tracks, screens and anchors. [figure 11] Tracks allow for objects to be hung and moved across the sheet; screens allow the transmission of light, air or view; while anchors allow for fixed fastening. The inscription of these cuts across sheets is driven by current and anticipated requirements of a space, such as lighting, storage, air circulation and view to mention but a few. The resulting panels blur the distinction between wall surface and furniture and by doing so; reconfigure the relationship between room, content and inhabitant. [figure 12]

Both instances suggest a multiplicity of conditions within a finite system of panels. The processes employed and the resulting forms establish a formal language capable of fulfilling various needs. Cuts for a handle may also double as a light diffuser. Although they may attach onto existing walls or ceilings, both the plywood and MDF panel systems are effectively portable and provide the potential for installation in multiple locations. As user moves, so can the interior surfaces of the rooms which enclose them. The resulting reconfiguration of the panels recalls previous installations while adapting to current needs.

ENDNOTES

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