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Visceral Items of the Hand: Digital Fabrication in Interior Design Pedagogy

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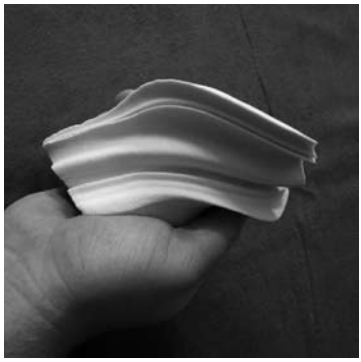


Introduction

General interior design education reconciles two distinct influences on overall pedagogy. The first is its traditional foundation of knowledge rooted in EXPERIENCE: a direct understanding and affinity for sound, light, color, pattern, texture, and materiality. The second is a preoccupation with the OBJECT: a concern for the primacy of form which is prevalent in the discipline of architecture, which has a fundamental relationship with the discipline of interior design. While both of these aspects have been based in the reality of "hands-on" understanding for much of their history, the increasing role of digital/virtual techniques in design-education environments has intensified a tension between the two. This tension can manifest in interior design students as a disdain for abstract representations, be they digital or merely orthographic; and may contribute to the observable disjuncture between the levels of use of digital design technologies in the two disciplines educationally and professionally.

This paper attempts to ease the tension between these two aspects of interior design pedagogy by exposing the underlying learning desires built into them, and proposing a beginning digital design pedagogy which bridges the gap between traditional analog methods rooted in experience, and contemporary digital methods rooted in digital object visualization. This bridge is facilitated by the use of digital fabrication technologies which translate the virtual into the tactile, the digital into the analog, the abstract into the concrete.

Modes of design difference

Architecture is the magnificent and orderly play of masses in light.
LeCorbusier (Eaton 2005)

As individuals we are able, both consciously and unconsciously, to appreciate the qualities of space, but it is the materials, textures and colours used in that space to which we ultimately relate. (Coles & House 2007, p.77)

Interior design and architecture are self-evidently related, with a zone of overlap that allows many designers of both types to practice in both areas. Overlooked in the coincidences of product, however, are the differences of design origins and process that occur with the two disciplines.
It may seem overly-simplistic to say that architects design from the outside in, and interior designers from the inside out. Nevertheless, it highlights that architects tend to begin with issues of scale that allow for, even require, a certain level of preoccupation with the abstract object; while interior designers tend to begin with issues of intimacy that push for earlier material and spatial resolution. While all design must concern itself with materiality on some level, the haptic nature of interiors requires successful interior designers to be aware of a project's material and experiential factors early in the design process.
This distinction of approach is apparent in early design education. Students entering architecture programs tend towards notions of object assembly, often having grown up making models and playing with various unit-based toys such as Legos. Interior design students, by contrast, are more likely to have chosen their design path based upon a fascination with sensory experiences such as light, texture, and pattern. Assembly is relegated to the juxtaposition of different materials in proximity, but not necessarily joinery. These dispositions can frame how students approach a design problem, what they may value in the process, and what goals they establish for evaluation of their work.
These proclivities are often reinforced in basic design pedagogy. Beginning interior design students learn about color theory, textiles, materials, and their spatial impacts early in their education, which then serve as basic elements of craft. These elements are directly experienced by the hand and eye of the student through selection, model-making, and rendering. In contrast, the white "kit-of-parts" is a common teaching tool for architects. Kits usually contain abstracted columns, walls, distinctive roof elements, and are assembled on a base, reinforcing architectural design as the assembly of elements to create formal objects. While kits are sometimes used within a container for interior design instruction, they are usually still critiqued as object assemblies from above and not spaces from within. Additionally, their usual lack of color and surface/texture distinction removes a fundamental part of the interior designer's method of articulating space. This "object vs. spatial" dichotomy ripples throughout education, lessening as students become more immersed in the demands and complexities of a full project, but never fully disappearing. The perspective rendering remains a preferred method of drawn communication for many interior designers, due to its ability to better communicate the subjectivity of material and spatial experience; while architects favor monochromatic models which communicate the building as an objective whole.

Digital design avoidance

Most digital design software was originally developed for the design of airplanes and ships, which are first and foremost objects affected by the exterior environment. Since digital pedagogy is currently driven by architects, there is a tendency to start with the abstract virtual surface or object, exploring the various systems that can influence and/or generate form. As a result, much digital architecture is decidedly non-material, expressed as fluid, unbroken form.

Given the bias just articulated, it should come as no surprise that digital design, in the broad but current use of the term, has been more readily embraced by architectural designers than their interior counterparts. There is "an emerging trend to use computers not only to incite design images but also to produce interior architecture pieces." (Seuyoshi 2006). The leaders in this trend, however, tend to be architects who use interiors as a testing ground for larger architectural ideas. Digital design is still avoided by interior designers, especially in education. A few examples:

1) The 45th Annual Interior Design Educators Council conference, Montreal 2008: Out of one hundred papers presented, only four dealt with digital technology in any form. One discussed student use of online communities, and two dealt with the use of BIM in professional practice. The only one which expressly dealt with "digital design curricula" focused on an AutoCAD-based curriculum. (IDEC 2008)

2) Student survey, Louisiana Tech University: In a recent survey conducted of upper-level interior design students who have been exposed to various digital software programs, they expressed a preference for designing with AutoCAD to using 3-D modeling applications. Their expressed reasoning; that it was easier to use, based on an understanding of "drawing" over virtual objects. When asked to choose only between 3-D applications, they showed a preference for SketchUp, due to a) the ease with which a design's surfaces and objects can be differentiated with color and material; and b) the built-in feature of human walk-through, with great freedom to set eye height, speed, and movement. These were seen as more desirable features than the greater formal freedom offered by NURBS modelers such as Rhino. (Survey conducted by author)

New strategies

The computer creates a distance between the maker and the object whereas drawing by hand as well as model-making put the designer into a haptic contact with the object or space. In our imagination, the object is simultaneously held in the hand and inside the head, and the imagined and projected physical image is modified by our bodies. (Pallasmaa 2005, pp.12-13)

It is not the point of this paper to imply that interior designers are incapable of digital design; only that much digital pedagogy operates at odds with interior design processes and concerns. Therefore, what are proposed are some beginning digital pedagogical strategies developed by the author in recent interior design coursework. These strategies center on the use of digital fabrication, alteration, and patterning techniques to create a new set of analog materials and elements with digital origins. These visceral items of the hand establish experience and sensory interaction as primary means of evaluation, and allow for the learning of software rooted in haptic, as opposed to virtual, goals.

Strategy 1: Digital Wallpaper

Pattern – a unit, acts of repetition, and a system of organizational rhythm – lies at the heart of many aspects of color, texture, and material assembly, and is therefore readily embraced by the interior design student. This strategy challenges students to ponder both the visual and non-visual sensory implications of colors, and translate these into pattern.

Students gather inspirational content relating to four conceptual phrases: 'the flavor of', 'the melody of', 'the aroma of', and 'the texture of' various colors selected from a list. For each phrase, they gather inspirational images of things, materials, textiles, forms, views, fragments, juxtapositions, etc. that they feel capture, connect to, or evoke an experience of the phrase. From these, they develop 2-D digital patterns; using digital photo and illustration software to abstract, alter, repeat, super-impose, and extract from the imagery. The resulting pattern blocks, when printed, serve as units of "digital wallpaper," to be explored and installed across existing surfaces.

Strategy 2: Digital Surface

Once development of pattern graphics is complete, raster and vector information is extracted and applied to the fabrication of surface transformations. Various surfaces and finishes of haptic immediacy are produced from exploration of the same pattern under different hardware, software, and material conditions. Using CNC laser and router techniques, students fabricate surfaces which may be directly tested for lighting, texture, and combinatory effects. Techniques include:

Image etching: raster-printing the pattern with a laser onto heterogeneous materials to reinterpret the pattern image. Depending on the power settings, underlying layers become partially exposed, and different material layers may chromatically shift.

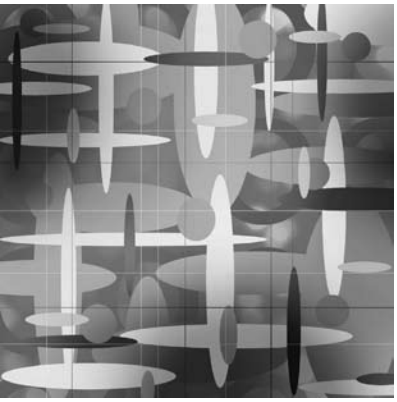
Texture etching: printing the pattern with a laser onto homogeneous materials (wood, plaster, paperboard, etc.) to alter the surface. Smooth materials gain a tactility of depth and intricacy which can be experienced by the hand of the student designer.

Textile layering: cutting the pattern out of felt and then sewing this to another layer of fabric to create a new, multi-level textile. With this technique, the pattern must be analyzed and adjusted to provide connective boundaries in the material. Various color relationships can be explored in combination with pre-existing textile patterns. The textiles are malleable, able to be suspended, wrapped, folded, and secured to themselves.

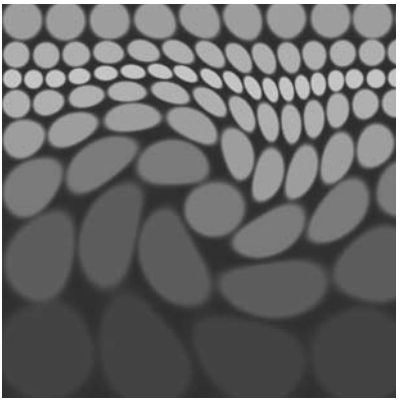
Routed surface: translating the pattern through "height-field" or "draped objects" explorations to produce a parametric surface which can be 3-D printed or routed from a larger volume of wood or foam. The resulting blocks serve as digital tiles and allow for new pattern discovery through repositioning and interaction with other pattern units.

Strategy 3: Digital Curtain

With this strategy, emphasis is placed on alterations which adjust the opacity of planar materials; opaque materials are penetrated and transparent materials are obscured. Digital information may be derived from developed patterns and/or from additional imagery. The results are suspended or otherwise supported to allow observation of their light and vision-altering properties. Techniques include:



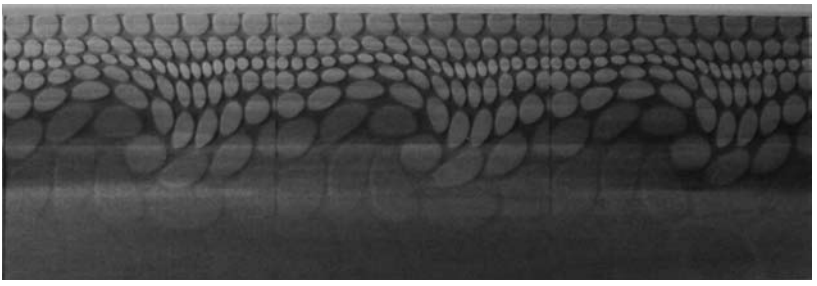
The Texture of Tan



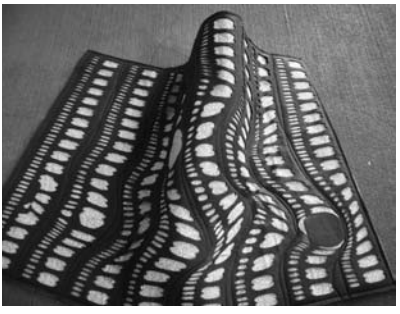
The Aroma of Turquoise

The Melody of Scarlet

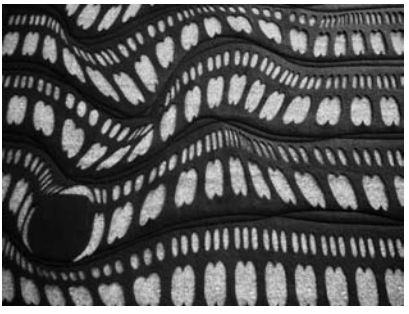
Wood Texture #1



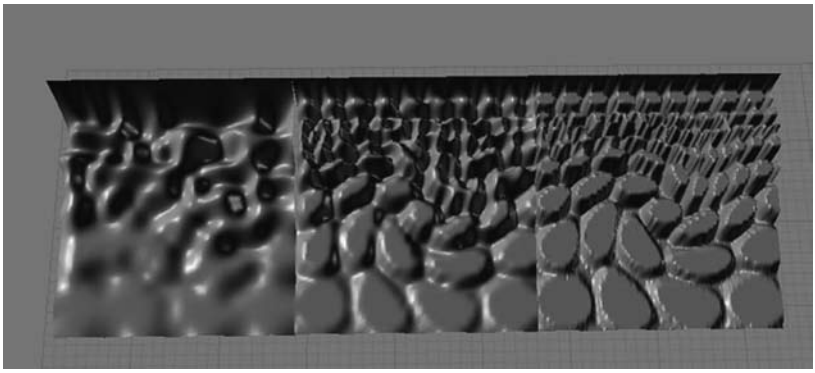
Wood Texture #2



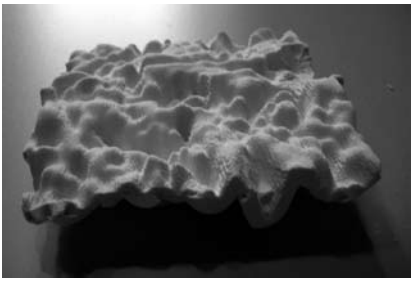
Digital Textile



Textile Detail



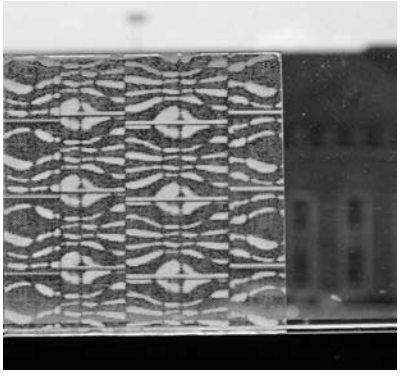
Heightfield Sequence



Heightfield Print

Acrylic Blurring

Harlequin Penetration



Leaves Pixelation

Pixelation Manipulation Study

Blurring: raster-printing the pattern with a laser onto acrylic or other plastics to create varied levels of translucency in the material.
Penetration: laser-cutting the pattern out of opaque material to create an interlaced experience of solid and void. With this technique, the pattern must be analyzed and adjusted to provide connective boundaries in the material.
Pixelation: translation of pattern and imagery into a rastered mesh, encoding information through changes in circle size. This technique creates a field-pattern which dapples light and reveals complex visual information peripherally and at a distance. The method works well in conjunction with both the blurring and penetration techniques.

Strategy 4: Digital Form

At this final stage of exploration, students craft 3-D formal expressions of aspects of the patterns. The vector information is imported into a NURBS modeling program, where parts can be separated, repositioned, lofted, and extruded into solid form. These virtual objects can be manipulated, twisted, scaled, combined, and transformed in myriad ways. The objects are rapidly prototyped using a 3-D printer, and sectioned/contoured for layered or ribbed fabrication on the laser. Foregoing functional considerations in favor of phenomenological discussions, the key is to evaluate these elements *after* prototype fabrication, where their responses to light, movement, and perspective can be directly experienced by the students.

Conclusion

By initially refocusing the emphasis off of virtual objects created digitally onto real materials altered digitally, the haptic inclinations of the interior designer are harnessed to aid in digital understanding, instead of impeding the learning process. These *visceral items of the hand* serve as a haptic material palette which provide elements of direct experience for the body, and which can stimulate new notions of interior spatial and formal design. The digital exploration strategies facilitate an evolution from 2-D texture to 3-D texture, to 3-D form, in concepts that activate underlying learning desires. Analysis and experience of these surfaces and forms place abstruse digital processes into direct comparison with more familiar notions of materiality, bypassing mental roadblocks and eliciting a desire for more immersive digital spatial exploration.

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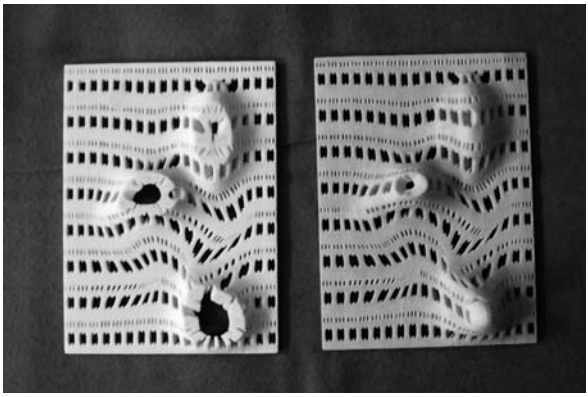
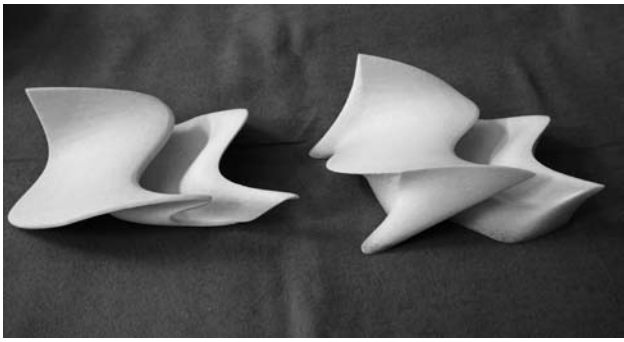


Penetration Prints



Surface and Solid

Twist Object #1

Curved Enclosure

Cardboard Contoured Unit