Virtual Tactility: Working to Overcome Perceptual and Conceptual Barriers in the Digital Design Studio

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Abstract
In the digital age, what is the role of tactility in the digital design process as it is taught in schools of architecture today? Often, students are never taught to appeal to any sense other than sight, particularly now as digital media is embraced as a valuable design tool. Yet, are there some essential characteristics of architecture and the phenomenology of place making that is being cast aside due to the nature of the tools being used? However true or enigmatic this may be, there is a way of working and teaching that exists somewhere between the digital and the tactile.

This paper postulates a hybrid working environment in the design studio that not only takes advantage of the strengths of various design media, but also focuses on reinterpreting its limits and drawbacks. The ultimate outcome will be a new digital media (intermedia) pedagogy that can revolutionize the way that we teach architecture and, moreover, computer "aided" design.

What is the Problem?
One of the primary problems with CAD as it is taught in many schools of architecture is that it is taught at the very end of the undergraduate studio sequence as a tool to be used in internships. CAD often is relegated to a semester of two-dimensional drafting followed by a semester of rendering (and maybe animation). The timing and sequence of this sort of computer instruction restricts digital media to pure production rather than design (conceptualization). The resulting drawings are usually banal, uninspired, and flat (little layering and depth).

Fig. 1 Overly textured brick form z rendering by fundamental design student Derek Drish.

The opposite problem exists at other institutions that introduce younger students to basic modeling programs that seldom encourage students to continue developing their ideas once they are entranced by the digital visualization before them. Student work of this variety is fraught with overly textured image-mapped surfaces devoid of subtlety, no connection to the land (site), and lack of subtlety and detail development. There usually is little to no understanding of the realities of construction or structure, and little concern in resulting animations for the accurate portrayal of human sequence. Only a carefully constructed curriculum that is closely keyed into the studio sequence can avoid these pitfalls

and foster a new engagement of the senses (as appropriate in the multi-sensual environment of architecture) beyond the purely visual.

Redefining tactility and the role of intuition

Tactility is defined as a quality "of or connected with the sense of touch."[1] The author has expanded the definition of tactility to encompass the perception of touch-related sensations (as in the photograph of a texture) and the ability to derive perceptual realizations through direct physical touch. This refers to an understanding of one's environment through actual touch, or the perception of what a touch would be like as well as discoveries found through the touching, manipulating, and assessing of materials.

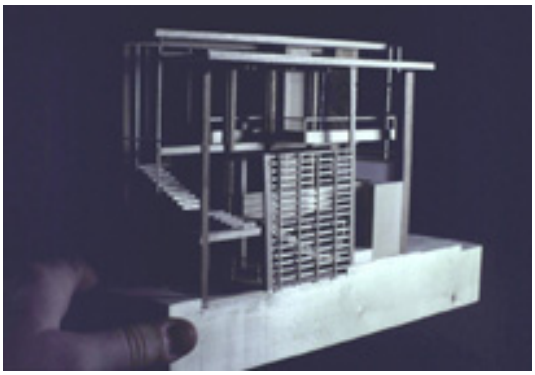

Figure 1

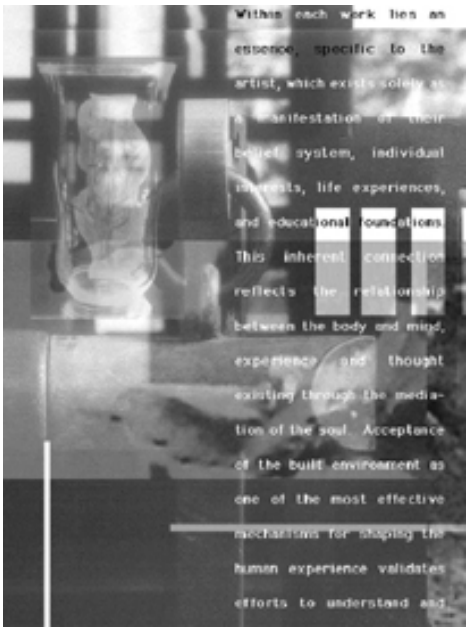

Figure 2

Fig. 2 Fundamental design student Meri Tepper holding physical model.

Fig. 3 Conceptual collage by graduate student Linda Chervenak. A series of these collages were sequentially placed onto a timeline in Premiere to create a narrative of the project.

The sense of touch, even the visual extension of the sense of touch, responds to tactile cues contained in media, and through comparison with remembered sensations, draws conclusions about the corporeality and palpability of it and what it may represent (design media). Directly or indirectly, tactility and in general a synthesis of the senses plays a strong part in how we perceive the world around us and, particularly relating to architecture, how we perceive and conceive the built environment. Thus, when working with architectural digital media, a media which is by nature visually is based, one must be careful to engage more than just the sense of sight by virtue of how one represents the subject matter (i.e. proposed projects, existing building sites, etc.). This is of paramount importance in rendering visible an architectural space. [2]

Collage

In the process of redesigning a computer curriculum, the problem of non-tactile computer work is being addressed in three major categories: input of design data, digital processing of design data, and output of design data. Using the notion of collage as a starting point, new design pedagogy can be authored that encourages the seamless integration of digital and analog design media. As we gradually introduce to students the tenets of design from semester to semester, beginning with basic formal manipulation and analysis and leading up to more complex design issues, a similar sequence can be created to

introduce digital media. Instead of being taught in separate, stand-alone drafting and modeling courses, students begin a truly multi-media design curriculum in a way that requires them to switch from one way of thinking/working to another automatically and back again, resulting in work that is always layered, tactile, evocative, and precise.

The problems I believe are at least threefold, and a careful examination and reworking of the use of digital media in any curriculum can yield drastic improvements. First, the process by which design data are currently entered into the computer is not conducive to a holistic, multi-sensual method of designing within a physical environ. Can we intuit awareness of existing design determinants and even our own design intentions by simply moving a mouse around and tapping on a keyboard? We do indeed use our hands and touch the input devices, but do we *feel* anything more than plastic?

Second, the way in which design data are currently manipulated in the digital environment is not consistent with how we experience space and the world around us. Do students typically amalgamate virtual and real images, textures, or models during the design process, or do they work in a linear fashion and use one mode of exploration at a time?

Thirdly, the way that design data are currently outputted is not entrancing to the senses, does not reflect an inherent understanding of how the media is produced (i.e. brushstrokes), and is not truly and intuitively representational of the physicality of surfaces, textures, and forms indicative of the proposed architecture. Is there a way that computer prints and plots can become more tactile, or is there another means of output that is more conducive to tactility?

Fig. 4 Photomontage by fundamental design student Melissa Tronquet.

Inputting design data

Imagine for a moment the auspicious invention of digital clay. Utilizing electromagnetic pulses through the mass, the exact shape, size, and location of each sculpted piece of digital clay would be replicated digitally in virtual space. One would be able to watch the transformations occur in the virtual version in real time as the clay is worked. Instead of simply working with a mouse or a keyboard to input data to create virtual forms, or using a scanner to replicate physical objects in virtual space, one would directly create a virtual form with his hands.

As with clay, physical objects could be pressed into the clay, leaving a textural inverse of their surface. Stone, skin, hair, wood, engraving plates basically anything could have its particular relief digitized in such a fashion. One could observe in real time the transformation of form in virtual space and could

record such change in animation form. The possibilities of such an invention will be monumental to how designers and students of design will be able to work digitally.

The application in which the virtual model is created would have tools that automatically regularize the surfaces and edges in any modules or to any tolerances inputted by the user. In this way, the designer can work with the clay as quickly and freely, or as methodically and carefully as desired. One also would be able to use X-Y-Z grid snaps, directional snaps, and orthogonal snaps that when activated would force the virtual replication to lock into whatever level of control the user needs.

Manipulating design data

Once data is inputted into a computer, it is typically held there by the student until the resulting drawing or model has been completed. Students tend to be reluctant to output a digital construction in order to complete it by hand. [3] The general view held by students is that digital media *replaces* analog media rather than augments it. The problem does not lie in the software or the hardware, but instead in the attitude toward using digital media. One can introduce students to the great benefit of utilizing multiple media simultaneously and interdependently. A combination of various representational and analytic modes will produce a *gestalt* composition that can make use of the limitations of each tool and create a much richer project than is otherwise possible. This attitude is dependent on how digital media as a design tool is introduced, the sequence of instruction, and the type of project assigned and studied.[4]

An appropriate introduction to digital media is one that encourages students to work with subject matter that is inputted from the corporeal realm rather than created solely in the digital realm. Imaging software (such as Adobe PhotoShop) and scanning should be the first lessons in working in digital media. The student should actually be required to procure or produce analog media to input. Students can then be taught recombination techniques as well as photomontage and collage. If the introduction occurs within or aligned with a fundamental design studio where analysis is introduced prior to design, then analytic techniques can be introduced using the imaging software.

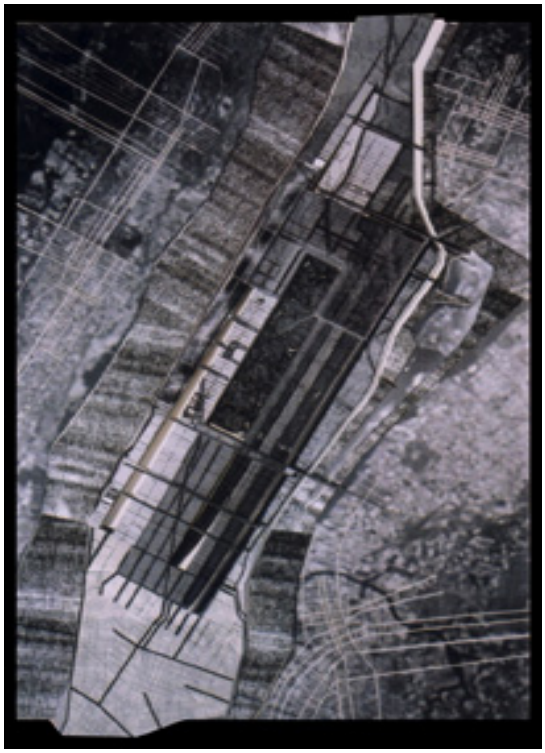

Fig. 5 Analytic collage by third year student Duy Ho.

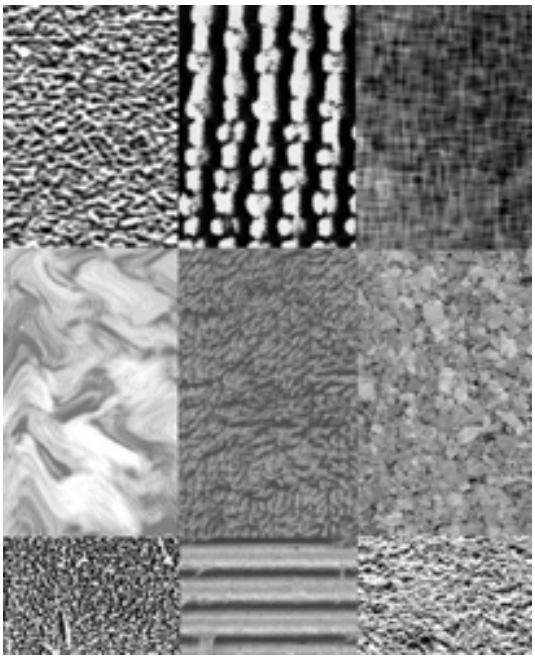

Fig. 6 Assortment of typical collage materials.

In figure five, the student used PhotoShop to analyze the structure of Richmond, Virginia. Topography, urban infill patterns, blocks, and streets are all created using diagrams and patterns scanned into the computer. Working with "real" patterns and textures, the student cannot help but create tactile work. Even when the textures are digitally manipulated and transformed, their original tactile quality can be authentically retained.

It is essential that students learn to output these first exercises soon after their completion in order to transform them manually. From the printed analytic collages, students can create multi-layered physical models of their cities (Richmond, Virginia in this case) and extrude in three dimensions what verticality they could only infer in the computer. If certain readings in their digital collages lacked coherence or clarity, it is at this time that students can manually create additional layers and edit their work. By demonstrating the interchangeability of digital and analog working methods in this manner, at an early stage in an architectural curriculum, students tend not to learn to separate the design tools. This latter problem is more indicative of stand-alone CAD courses and introductions to digital media occurring too late in the curriculum.

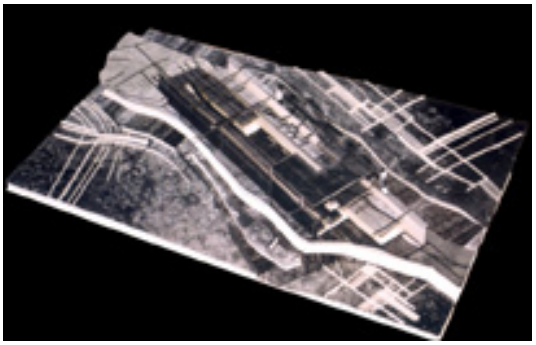

Figure 7

Figure 8

Fig. 7 Analytic collage model derived from analytic collage in fig. 5. Ideas of height and layering inferred in the two-dimensional collage are physically extruded.

Fig. 8 Form Z rendering with montaged scale figures by Xavier Garcia. Note the concrete pattern used as a texture and image map.

The next level of interplay between digital and analog modes would require that the physical models be somehow scanned into the computer and further manipulated digitally. Using a scanning wand**,** three-dimensional models can be inputted and translated into digital models. These digital models can then be developed further as architectural projects. One of the greatest assets that this phase of the project allows is the virtual inhabitation of the project so that it can be further resolved from the viewpoint of a user. Sequence of space can be studied by "moving" through the project, and materials can be applied (using scanned textures) to approximate the experience of actually inhabiting the intended spaces. [5]

At this point, if certain materials cannot be convincingly manipulated or created digitally, the student can simply print the unfinished perspectival views of the project to be manually rendered. In this manner, the work retains a level of artistic sophistication that arguably might only be possible by working the image by hand. Architectural projects are by their very nature speculative up to a certain point of construction, and often a more speculative, sketchy representation technique of a designer's intentions will yield a warmer, more engaging conversation about the architecture.

Output

The intended experiential qualities of architecture can be conveyed and studied simply by working with media that do not only appeal to the sense of sight, but engage a combination of senses, promoting a multi-sensual gestalt understanding of a project.

When contemplating the need for conveying intentions, the vehicle for the transmission of ideas is critical. Without the proper manner of conveyance, or output, communication is impossible. Students need to be encouraged to think beyond typical print media and models to communicate their design intentions. Sonic recordings, material samples, full scale details, and other similar techniques of exploring the phenomenological characteristics of a project both deepen a student's understanding of his work and more thoroughly describes the essential quality of inhabitation being designed. It is perhaps the computer that in the near future can provide a truly multi-sensory understanding of a project through the use of smell synthesizers, sound samplers, photomontage animations, texture synthesizers, and thermal radiators, all technologies in existence today.

Strangely, the problem is not necessarily the inability to make the computer more *tactile*. Rather, it is how students view the relationship between digital output and completion. Once an output device has delivered a plot or print to a student's eager hands, the task is commonly viewed as 100% complete. Whatever the condition of the drawing at this point (in regards to line weight, trimmed corners, hatching and shading, etc.), it is what it is and will be presented as such. Perhaps students put too much trust in the capabilities of the computer to "create" their presentation drawings for them, rather than regarding the computer as merely a tool representing only a part of the process. Instead, students should be encouraged to intervene in the evolution of the drawing, and render visible the textures and irregularities that exist in reality, and in doing so transform otherwise purely digital creations into artistic endeavors.

Conclusions

So, the mental barrier that the process ends upon the print must be broken if digital media are to have the tactile appeal to the senses that other sorts of media have. Printing to other sorts of media other than standard bond paper (i.e. watercolor paper, cloth, etc.) can gain a tooth to the print, but inherently the image upon the paper is still devoid of time. Time is readily perceived in projects that are worked and layered as part of a process of conception, and allows the work to transcend the canvas, becoming much more than paint (ink, pencil, etc.) on paper. The work instead becomes "real" and imperfect.

Architecture is inherently a human act. It is conceived of and created by a human being ultimately for other human beings. Architecture is experienced spatially by all of our human senses, not just one, and it is the combined collage of sensory input that constitutes our perception of it. If there is a lack of sensory input in the perception of a place (i.e. as in a photograph), the human mind cannot fully embrace an understanding of the place, whether natural or built. The result is an incomplete, superficial engagement.

Why then should the act of design be anything less than a truly multi-sensory experience when it is possible to work in such a manner. It is this manner in which the designer uses the computer as a design tool that can be carefully shaped to produce work that is significantly holistic in its engagement of the senses. A careful sequence of study that maintains an emphasis on the physicality of the world and moves between analog and digital modes of working will take advantage of the limitations of digital media, and will reinterpret them into tactile working methods. [6]

Notes:

1 The Concise Oxford Dictionary of Current English, Claredon Press, Oxford, England, 1990, page 1241. Other similar definitions contain similar references to the sense of touch, of course. The Oxford Dictionary continues on to describe "tactility" as being "tangible" and "concerning the effect of three-dimensional solidity." Arguably, one can make the assertion that there is a visual extension of the sense of touch, similar to the "synesthesia" described by Diane Ackerman in A Natural History of the Senses, Vintage Books, New York, NY, 1991.

2 When the body and mind encounter an architectural (or other) image that contains surfaces and textures to which it cannot relate, a degree of intuitive understanding is inherently lost. The perception of the subject is more limited and superficial, the understanding of it lessened.

3 How many of us have seen students grow fascinated with using the computer, and reveling in how digital, how slick and ephemeral their projects become? I remember hearing a student remark after a live performance that the musicians sound almost as good as they sounded on their CD. In the digital world of late capitalism, the simulacra of recorded media is preferred by many to the actual performance that the CD is trying to emulate.

4 After developing and teaching digital media courses at two universities, and being a graduate teaching assistant instrumental in developing one at another, I have seen that digital media courses that actively teach the tool as a design tool rather than just a representation tool yield a more seamless integration of the tool with the design studio. Moreover, students using the tool for projects they are designing for studio tend to bring the computer into the studio rather than just working in a separate lab. Because the projects being used are the students' designs, they tend to put more time and energy into their digital renderings and drawings.

5 Heidegger's *Place* vs. *CyberPlace*

"…the French philosopher Rene Descartes, using algebra and a coordinate system, developed an abstract geometry that also enabled the description of three-dimensional perspective on a two-dimensional plane. With Descarte's geometry, there was no need for tools or, in fact, for reference to the real world. His method defined abstract objects in an imaginary world of a selected coordinate space, and gave equations to calculate points of intersection, perspective, and depth algebraically." (Steven R. Holtzman, Digital Mantras: The Language of Abstract and Virtual Worlds, The MIT Press, Cambridge, Massachusetts 1994, pg. 194.)

6 Please note that this paper serves more as a discussion of possibilities than it does a research report. In inventing a computer curriculum at the University of Florida, reflecting back on my prior utilization of digital media and the architectural design process, and researching the curricula of other institutions, these thoughts have emerged. The question of appropriateness is always coupled with possibilities, as is the history of representation in architecture coupled with an understanding of perception.