Persistence of Perception: Encoding Reality

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Designing Common Realities

“Liquid architecture makes liquid cities, cities that change at the shift of value, where visitors with different backgrounds see different landmarks, where neighborhoods vary with ideas held in common, and evolve as the ideas mature or dissolve.” In 1991, Marcos Novak in ‘Liquid Architectures in Cyberspace’ projected a future of individual and blended realities of things perceived and perceived things – a place of “fertile dreams”. In the cathedral, “The dream and making were one.” In the present he concludes, “Curiously the practice of architecture has become increasingly disengaged from those dreams.”

This paper addresses inherent limitations in today’s digital technology that restrict its ability to participate in the future design of the “fertile dream.” It does not address the technology required, but the requirements of the technology. In 2003, architecture is beneficiary of many advantages bestowed in the digital era, and two stand out: productivity gains in document management and production, and building manufacturing and production. Additional productivity benefits flow from their synergistic integration. Unfortunately, a constriction has emerged at the user interface; the consequence is that the user’s message looses meaning between his or her brain and the computer.

The Designer’s Score

Architectural design is a four dimensional event, three dimensions of space and one dimension in time. CAD was developed as a fixed-time two dimensional design application – architects and software makers have attempted to overcome these limitations in the user interface, but it is a significant challenge. The user interface is hindered by today’s reliance on the two dimensional visual display; while it is possible to validate three dimensional design information in two, designing three dimensional architecture in two degrades the more powerful symbolic language of traditional notation.

Cognitive psychologist Nelson Goodman refers to the architect’s papers as a “curious mixture,” where a drawing does not function simply as a sketch with measurement, but where “…the particular selection of drawing and numerals in an architectural plan counts as a digital diagram and as a score.” (Goodman, 1976) By creating a volumetric solution first (3D design programs), then extracting the digital diagram second, the role of the score and composition are reversed. Thus, the layered precision and rich symbolic language in the traditional designer’s score is lost, and the plan or section becomes a derivative of the visual gesture, a simple construction document.

Exceeding the Designer’s Perceptual Abilities

The limited dimensional interface of the computer monitor requires a choice of what comes first, or what is a priority; and integrating another dimension of space or time under these constraints will always degrade the performance of competing information in the design channel. For example, the traditional architectural plan, much like a written narrative, is constructed in a symbolic language but with unique visual rules of grammar. Unlike a book that sequences words in memory, the traditional architectural plan employs symbolic notation to facilitate the simultaneous presentation of the visual narrative. Traditional media is also layered, a technique that insures the coordination between related scores, for example, structural, functional, and regulatory.

Computer Aided Design software significantly improves on the management of and accuracy of hand drawn notation, however high resolution screens degrade the simultaneous presentation of the symbolic score; an E size drawing would requires 5-10 sequential segments; in practice, these pages are printed, reviewed, then revised in the computer. The improved accuracy of the digital information and the increased productivity make this a highly advantageous tradeoff. However, if an additional spatial dimension is added and the designer sculpts the architecture, the negative consequences are compounded.

In addition to the loss of the rich language of the symbolic score, and the limited ability to display simultaneous high-fidelity visual imagery, the third dimension by default becomes dependent on the designer's memory. Dimensional views are not simultaneously presented to the designer, but must be committed to memory – therefore, complex designs quickly exceed the designer's perceptual limits of both memory and visual acuity. At present, the planar visual interface will not accommodate additional information in the design channels without negative consequences. The eventual solution is conceptually straightforward; the symbolic user interface must be increased by one dimension of space and one dimension of time. (Flanagan and Juhasz, 2002)

Restrictions in Message Carrier Operations

There is a dimensional restriction in the user/machine interface in the common computer environment: the message carrier is limited to two visual dimensions on the computer screen, plus a partial or implied third dimension of either space or time; it is implied because memory must be invoked in its operation. The practical result is a 2 ½ dimension design interface and a 3 dimensional communication interface. A full user interface requires 4 dimensions, three of space and one of time.

A message carrier is a container or vehicle to communicate a designer's instructions, referred to here as packets. The container requires a full spectrum of communication channels for simultaneous communication, or it must restrict its content to those dimensions available, therefore restricting content. A computer screen interface restricts how packets are used, the information packet must be sent through the computer interface sequentially, and then recombined by the designer (somewhere in the design process). For example, CAD information (visual) requires three dimensions of space, while film media (visual and sound) requires two dimensions of space and one of time. While very capable modeling and video software exists today; the present interface would severely degrade its combined and simultaneous communication in the user/machine interface.

If the designer could communicate through an unrestricted interface, there would be an improvement in the coordination of quality, quantity and fidelity in the information stream. An enhanced dimensional interface would accommodate communication of multiple, concurrent channels of multisensory design information.

Theoretical Limits

Additional channels in the multidimensional user interface, unencumbered by an overburdened visual interface will exponentially improve simultaneous communication between the brain and the computer. The prerequisite is the addition of a third information dimension in the symbolic user interface of sufficient visual resolution and data capacity to accommodate concurrent multidimensional communication. Since architecture is the design of experiences and spaces, and not just buildings, designers of blended realities will require this capability.

Two emergent technologies are at the threshold of commercial development: The soonest in production, the three-dimensional visual interface, will integrate a three dimensional virtual design space with bi-lateral hand control; it is an initial use of the technology to create blended realities, the world of perceived things and things perceived. The exact configuration of this technology, as it will appear in the architectural office is unclear and beyond the scope of this discussion. Nevertheless, the nascent technology to create Novak's "liquid architecture" is infiltrating everyday life. Digital airline operators already augment their human counterpart, albeit primitively; the user/machine exchange employs an audio channel in a perceived question and answer session. (Flanagan and Juhasz, 2002)

Even if the multidimensional technology were to magically appear, the symbolic design environment would need to be developed – visualization alone would be scant justification for this enormously complex and costly undertaking. Forward thinking designers will develop simultaneous strategies to design multidimensional experiences in this multidimensional interface.

Bridging the Technological Chasm

A design strategy that I have developed to bridge the inevitable technological chasm, of present technology and future multidimensional technology, is the *Memory Diagram*; it is an idea oriented, layered, symbolic, schematic diagram from which all design implementations flow. *Memory Diagrams* employ the dimensional coordinates xyz + t (time) in a sequential visual and sound composition; its symbolic message is only fully realizable in memory, and that is its limitation. (Flanagan, 2001) Its audio-visual construction is similar in the television commercial, a demonstrated technique to improve on its memory potential.

Constructing Virtuality

With the exception of persistence of vision in film (c. 1850's), a unique perceptual phenomenon, designers have been relegated to translating analogue into digital theory (including this author). A dimensionally enhanced user interface will likely resemble an interactive three dimensional film; fortuitously, discrete frames in film are a definable as sections in time; 20 or more picture frames per second simulate perceptual continuity (the brain is easily fooled), greatly simplifying virtual design construction.

In preparation for virtual design construction, the requirement to accurately registering virtual and real phenomena is at hand, hereafter referred to as virtuality. In a movie theater, a projector is aimed at a screen and neither the screen or the projector move; it is an accurate registration of the persistence of vision phenomena, projected on its substrate. The movements of the projected image, its substrate, as well as the audience are all potential variables in virtual constructions. The accurate registration of all three variables is essential consideration in the construction of virtuality. (Flanagan and Juhasz, 2002)

Registering Virtuality, Photogrammetry

Photogrammetry is the same principle of optics that allowed Renaissance artists to deconstruct and reconstruct mathematically accurate perspectives. Philip Steadman in Vermeer's Camera theorized that the use of camera obscura was more than just a casual novelty in the 17th century; its use enabled the Dutch painter to accurately deconstruct, and then reconstruct the scene's geometry, in a new and improved virtual configuration. Then, its computational complexity required a laborious media interface, making its use cumbersome; today the computer effortlessly performs these media calculations. Steadman's work has been criticized for potentially diminishing the creative contribution of Vermeer; curiously, if Steadman is correct, Vermeer was a founding contributor in the establishment of virtuality.

By deconstructing the geometry in a photographic perspective, the camera's locations and the scenes geometry are measurable. In digital technology, the view of the determinant (building and environment) is not fixed; photogrammetric reconstructions permit new camera placement to record new perspectives of the material geometries of the picture (or pictures). Reflecting on Vermeer's application, the objects in the scene are movable. Two or more pictures, or one picture and knowledge of the camera's optics, result in visually accurate metrics; each contributes information to the virtual representation. The principle is extensible to the entire universe of recorded visual imagery.

In deconstructing a film's perspective, the dimension of time is recorded in discrete frames along a timeline. The apparent synthesis of movement depends on the phenomenon, persistence of vision. At 24-30 frames per second, photogrammetric software is presently capable of automating the objective reconstruction of the camera's metrics in each film frame; persistence of vision gives the illusion of seamless movement. Technological advances, particularly in automated photogrammetric scene reconstruction (and not simply camera metrics) are fundamental requirements awaiting development.

The camera obscura assisted Vermeer's in his virtual reconstructions - at a rate of one or two frames per year. While a practical process of automating Vermeer's camera obscura is still not available (but on the near horizon), it is the last major perceptual invention in the technological puzzle required to establish the blended reality in Marcos Novak's 'Liquid Architectures in Cyberspace.'

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