Digital Surfacing

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Broadly speaking, there has been a paradigm shift in the relationship between humans and technology: modern technologies are now seamlessly fused with our everyday existence, and digital media form a surface-scape that rivals our cityscapes and landscapes.

For many, the computer is "just a tool", a phrase that belittles the significant impact it has had in our culture. In architecture, computers and other digital technologies have promoted unprecedented exploration into geometry, surface expression and the temporal aspects of design. In addition, the hybrid of architecture and information space is gradually becoming a realizable practice.

In this era of digital and technological advancement, architects are beginning to examine notions of boundary, with specific attention given to the architectural surface. While in early twentieth century, modernists sought to convey deep space through the use of transparent materials, today, architects attempt to compress allusions to the depth of the interior into the surface of a building. Such shifts in architectural practice are the result of two related factors: the changing attitude towards binary oppositions in philosophy and architectural theory, and more importantly, the development of new technologies for architectural design and construction.

Theory: From Opposition to Smooth Transition

When reading histories and theories of architecture we are continuously faced with hierarchical oppositional terms that define the limits of architectural production. Dichotomies such as surface/depth, ornament/structure, masking/transparency, reduce architectural complexity to abstract duality, often privileging one term over the other.

In architectural discourse, ornament is regularly associated with the upper or outer surface, which can be scraped back to reveal the true inner architectural essence. While the term "surface" can invoke a discussion of materiality, its derivative, the "superficial" carries a much more negative undertone. Expressions like "it was not what it appeared to be on the surface" demonstrate the prevalent attitude towards surface as the covering and masking of real and true substance. Thus we are left with a familiar position that privileges depth, structure, clarity and rationality, and devaluates surface, ornament, translucency and play. While some theoreticians (like Gottfried Semper) reverse this relation, architectural theory in general maintains a preference for formal structure over surface effects.

In the late 1980s, Derridean and Post-structuralist thought, established a questioning of architecture's conceptual transparency, leading to the movement known as "Deconstructivist Architecture." This was seen as a shift from idealism and the totalitarianism of previous architecture. Jacques Derrida's notion of "trace" signified the pollution of binary oppositional categories stating that the divide between signifier/signified (appearance/essence; surface/depth) is not so clear-cut. Thus, a theory of "deconstruction" argues that everything and reality is produced discursively and therefore, within any cultural production (including architecture,) there lay a great deal of contradiction, which needs to be teased out or "deconstructed."

Unfortunately, the translation of such a view into architecture, has led some architects to ignore the realities of everyday existence in favour of textual and conceptual play. This contradictory game of signifiers has disturbed many, who see in it an ignorance of the material conditions of people's lives. Deconstructivist theories taken too far can either create timidity towards meaning and reality (since everything becomes a target for subversion,) or in combination with the "The death of the author,"[1] and the destabilization of the signified, they can create an atmosphere of indifference in which the desire to communicate meaning degrades to superficial playfulness.

Inevitably, such abstractions have paved the way for nihilistic theories of thinkers like Jean Baudrillard who declares the hegemony of simulacra and the disappearance of meaning. Our world, Baudrillard tells us, has become subsumed by the superficial surface and the seduction of absence. There is no meaning and we are left as satellites in aimless orbit around an empty centre, surrounded by floating images that no longer bear a relation to any reality whatsover.[2] That, according to

Baudrillard, is the world of "simulacra": the substitution of signs of the real for the real. In this state of "hyperreality," signifiers refer to other signifiers and meaning implodes. What remains for us, argues Baudrillard, is "melancholic fascination" since surface becomes the "superficial abyss" which drowns us all.

Although deconstruction has been pervasive in academia and remains a powerful method of inquiry, many architects have been unsatisfied with its influence, believing that architecture possesses a material presence that is not accommodated by the textually oriented philosophy of Derrida, or the nihilistic theories of Baudrillard. For them, the answer comes in the form of Gilles Deleuze and Felix Guattari's work, which offers a more positive outlook to our post-industrial condition. Although it is never developed at length in any one place, an expansive philosophy of surface can be extracted from their work that can help us analyze our cultural condition without nostalgia or hyper-cynicism.

Thus, in recent years there has been a move towards the thinking of Gilles Deleuze and Felix Guattari, in order to generate a theory that addresses architecture in its materiality, promotes non-hierarchical expansion, and paves the way for experimentation and creativity. The concepts of "The Fold"[3] or "Smooth Space"[4] have been of particular importance to contemporary architectural theory, which together with the new computer technology have resulted in a move towards "topology" with many of the designs produced devoting more emphasis to innovative surface structures and fluid metaphors of design.[5]

It is now possible to design complex, skin-like surfaces that are not only pleasing to the eye, but also perform structural operations. Moreover, architecture is slowly responding to Information culture by a process of surfacing volume-space into activated surfaces, as noticeable in the work of a number of leading and highly influential practitioners.[6]

Design: Surface-driven Modelling

The revolution is not so much in architectural form, as in architectural practice. Recently, new digital modelling software, like FormZ, Rhino, Maya, 3D Studio Max and Houdini, have enabled architects and designers to infuse new design processes into their work. Moreover, developments in new materials and construction techniques have allowed complex forms and surfaces to be manufactured quickly and cost-efficiently.

Many architects are now switching from their desktops to the computer screen, which has effected subtle changes in their designs. The majority of today's modelling software is surface-driven. This means that architectural design using such software, necessitates creating surfaces to which colour, texture and materiality is later added. "Wireframe" modelling does not provide an adequate level of development, whilst "Voxel-driven" three-dimensional modelling is too complicated and therefore slow and expensive. There is also a more subtle issue of representational economy. At an early stage in the design process, a designer is usually interested in rapid, un-encumbered exploration of ideas. Ambiguities do not cause major problems and may even become sources of creative ideas. In this context, two-dimensional surfaces are easier to manipulate and do not mire the designer in demands for details, and therefore work better than representations that emphasize completeness and consistency.

NURBS, Blobs, Metaforms, Isomorphic Surfaces and other complex geometries are now possible using surface-driven computer modelling software. Not only are these surface geometries possible, but they are also feasible as most often they take on structural responsibilities too. As a result, architecture can display a much more positive attitude toward surface design.

Construction: Manufacturing Diversity with Precision and Economy

Faceting, pixilation, triangulation and polygonization are ways in which complex computer-generated surfaces are simplified for mass production. Such techniques often gives a shimmering ornamental effect to the resultant built surfaces. Such processes break down complex geometries into planar facets, which can be cut using computer-controlled laser-cutters. This also allows finely detailed wooden models of buildings and contoured surfaces to be produced. Alternatively, the computer-controlled milling machines—that now find wide application in the manufacturing industry—can be employed to produce complex solid parts in metal or high-density foam.

Stereolithography is perhaps the most versatile technique, and despite its technical complexity and high cost, it has rapidly found a niche in medical imaging and mechanical parts design.[7] A stereolithography system passes computer-controlled lasers through a tank of polymer solution so that laser-induced polymerization occurs at specified locations. A similar techniques called "Contour Crafting" is being developed by Behrokh Khoshnevis of the University of Southern California, that uses a computer-controlled crane or gantry to build edifices rapidly and efficiently without manual labour. Using a quick-setting, concrete-like material, Contour Crafting forms the house's walls layer by layer until floors and ceilings are set in place by the crane. The system can even accommodate the insertion of structural components, like plumbing, wiring, utilities, as the layers are built. Khoshnevis claims that his system could build a complete home

in a single day, and its electrically powered crane would produce very little construction material waste.[8]

These new design techniques have paved the way for radical design processes followed by their correspondent theories. For example "Topological architecture" or "Hypersurface Architecture" is highly reliant on the computer's ability to easily manipulate non-uniform B-Spline curves, and the surfaces that can be extruded from them. "Blob architecture" or "Metamorphic Architecture" is a result of the ability to create surfaces using Metaballs of differing mass and attraction, which can be connected together to create complex forms and surfaces.

Contemporary thought is supported by contemporary technologies. Today, not only the nature of surface has changed, but also the nature of structure. Architecture can be seen as one conceptual entity, where surface and structure have a more homogeneous relationship with each other. Recent development of polymers, carbon fibres and other hybrid constructional materials, have allowed such views to be possible, where architecture does not separate its surface-effects from its structural function.[9] Such material possibilities work well with new theoretical developments of middle-out conditions, smooth exchange, folding and material presence. There is an emerging phenomenon in architecture and culture that attempts to go beyond schizophrenic or nihilistic interpretations of our complex world. As Perrella writes: "Prior to the divisions between things, there is a more pervasive connectedness."[10]

An Image of Thought for the Digital Era: Surfacing and the Surficial

Digital technology is the dominant technology today, and it is moving towards the flatness of surface. Much of the new compute, chip, and screen technologies are designed to take less space, and in fact to be incorporated into smaller and flatter devices. Surfaces are becoming sensitised, gathering various inputs from their surroundings and displaying them extensively. EPDs (Electronic Paper Displays), Touch-screen and projective technologies allow architectural surfaces to become alive.

Such new developments promise a *surficial* future for architecture.[11] This is not the hierarchical and the traditional model of the "superficial" where surfaces are seen as veiling depth or meaning, rather it is a material and earthly metaphor which equates surfaces with the expansive and exploratory *process of becoming*. From this point of view, time and evolution gain new significance, and thus new technologies are embraced as a rich source of inspiration.

As technology improves, definitions transform. E-paper, for example, is a screen that has the qualities of normal paper in that it is flexible and can be read in normal lighting conditions. It is economical to produce making it ideal for mass customization. E-paper brings the nocturnal electro-luminous screen to the world of surfaces displayed in daylight. This can bring fundamental change to architecture where every wall surface becomes a digital electronic display that is not restricted to the darkness of the night. Moreover, notions of surface and screen can become indistinguishable: architectural surfaces become sensitive, dynamic and unpredictable.

Avrum Stroll defines surfaces as borders.[12] In its role as shelter, habitation, construction and enclosure, architecture is concerned by definition with the problem of border: its major duties necessarily imply the demarcation of boundaries through creation of surfaces. Today, architecture is faced with a dilemma: to create borders in a culture that deconstructs and challenges borders; to create surfaces in a culture that attempts to rupture surface appearances. It is due to this paradoxical situation that increasingly cultural philosophy is becoming useful for architecture.

Combining contemporary technologies of surface with smooth metaphors of transformation requires a progression from surface as a noun to surface as a verb. It also requires seeing surface as a thick medium rather than an abstract, dividing plane. Thus, *Surfacing* as a model of thought can be explained through an aquatic metaphor.[13] In a stream both the deep currents and the surface effects they create, are essential components of the same homogenous entity. In other words, there is no clear hierarchy. Yet, while the wave on the surface of the stream is visible, the submerged currents are hidden from view. The same principle can apply to architecture. Surface and depth are material and immanent parts of the same architectural stream. Ornament and structure, or image and meaning have the same relationship. In this light, binary oppositions are not separate entities, but in fact inherently and originally connected. Thus, architectural essence is not masked by surfaces. It is in fact in a state of surfacing; it is continuously *becoming surface*.

To engage with surfaces in architecture is not an exercise in superficiality. Surfacing is not only giving something a surface, but also a process of becoming experientially apparent; of becoming an actuality. Stephen Perrella's "Hypersurface Theory" discusses such issues. Yet for surfaces to fuse the material with the virtual, the apparent with the essence, they need not be "hyper." To be hyper is to be overexcited, super-stimulated, excessive, on edge. As Pia Ednie-Brown writes: "Hypersurfacing unleashes the surface into bearing witness to an even more pronounced expression of the conditions of emergence. Hypersurfacing is an act of falling into the surface."[14] Before we fall into the surface,

however, we should acknowledge that every surface is always surfacing.

Architecture has always been an act of surfacing. The cave paintings at Lascaux, Egyptian hieroglyphics, Muslim geometries and calligraphies, the white facades of the International Style, the reflective titanium skin of the Bilbao Guggenheim, the shimmering facades of virtual architecture, all relish the power of surfaces. Deleuzian theories together with the emerging digital technologies can result in a condition where surface is no longer judged through opposition to a hidden depth. Surfacing as a design strategy attempts to go beyond the modernist hierarchy—set up by the ornament/structure duality—towards a much more creative and spirited approach to architecture, something that Gottfried Semper hinted towards in the nineteenth century.

Notes:

1 See Roland Barthes, "The Death of the Author", in *Image, Music, Text*, trans. Stephen Heath, Fontana, London 1977.
2 Jean Baudrillard, *Simulacra and Simulation*, p. 11.
3 See Gilles Deleuze, *The Fold: Leibniz and the Baroque*, London: Athlone, 1993.
4 See Gilles Deleuze and Guattari, Felix, *A thousand Plateaus*, London: Athlone Press, 1988, pp. 474–500.
5 See *Topological Architecture*.
6 See dECOi, Marcos Novak, Greg Lynn, Peter Eisenman, UN Studio and so on.
7 See also, "3D Printing" and "Rapid Prototyping": http://www.cc.utah.edu/~asn8200/rapid.html
8 See http://www.isi.edu/CRAFT/CC/modem.html and http://www.usc.edu/uscnews/stories/10009.html
9 Los Angeles-based Peter Testa Architects have challenged the conventional notions of the superficial by infusing surface with structure. Their Carbon Tower project, a forty-storey high-rise prototype, is produced using a software program called Weaver, written by the firm specifically to weave together ultra-light composite metals into a textile material that does away with the need for a core foundation, resulting in a building whose façade is simultaneously a self-contained support. Opportunities exist for weaving different colors of metals, or even fiber-optics into the walls of this building, thus allowing surface-play to become literally "woven" into the design process.
10 Stephen Perrella, H*ypersurface Theory: Architecture >< Culture*, *Architectural Design*, May/June 1998, p. 13.
11 "Surficial: of or pertaining to the surface of the earth." Oxford English Dictionary www.oed.com
12 See Avrum Stroll, *Surfaces*. Minneapolis: University of Minnesota Press, 1988.
13 Similar to Bergson's stream metaphor for perception and memory, present and past, actual and virtual. Experience is the theatre of these dynamics, where the invisible, or deeper layer, is always responsible for the emergence of whatever comes into view.
14 Pia Ednie-Brown, *'Falling into the Surface', Hypersurface Architecture II*, Stephen Perrella, (Ed), Architectural Design Academy Editions, vol 69, no. 9–10, London 1999, pp. 8–9.

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