Surfacing:
Significance and Surface-play in Architecture

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Binary categories are prevalent in architecture and help us define the world around us. One of the most debated oppositions in architecture is between surface design (ornament) and structural design (structure), often with the latter being prioritised over the other. Today we live in a world characterised by the hegemony of urbanity, imagery, advertising, display units, screens and other artificial surfaces. In this increasingly ocular existence, a discussion of surface and its significance for our understanding and experience of the world is of utmost importance. This paper attempts to explore what we mean by the term "surface" and how this can help develop an architecture that deals with surfaces without falling into the trap of superficiality. It shall be argued that a more positive attitude is required towards surface appearances, one which does not see them as deceitful barriers, rather as places of honest communication and creative interpretation. Moreover, we shall discuss how bodily metaphors can further exaggerate the separation between different elements of architecture, resulting in a hierarchical preference for one or the other. Finally, this paper aims to propose a conceptual approach, which sees architecture as one conceptual entity residing within the thickness of surface. It shall be argued that new computer modelling tools have the potential of creating a design environment well-suited to the exploration of surface design, appreciating the significance of surfaces for our experience of architecture.

Introduction

The hegemony of vision has been reinforced in our time by a multitude of technological inventions and the endless multiplication and production of images. We live in a world characterised by speed, which is often understood by instantaneous perceptions of the eye. Moreover, in cities and towns, we are surrounded by architectural surfaces that often communicate to us on a visual level alone. In this world dominated by vision, surfaces talk to the eyes.

This ocular existence however, creates a distancing effect that reinforces an archaic suspicion towards surfaces as superficial or deceitful layers that mask a reality beyond. In the realm of architecture, this mistrust translates itself into the association of surface design with temporariness, frivolity, superficiality and excess, whilst structural design is given priority and gravity by an association with depth, essence and honesty in architecture.

Such dichotomisation was an important element of early twentieth century architecture, inspired by the popularity of frame construction, and driven by the logic of capitalism and the industrial revolution. Today, capitalism and more importantly the technology that go with it have transformed considerably. New digital technologies of design and construction can now offer a more trans-formative approach to architecture, which must result in a process of reconsideration and re-evaluation of design strategies and our conception of architecture.

Thus, a discussion of surface in architecture problematizes traditional architectural associations - highlighted by the ornament/structure debate - in order to better understand the role of surface design in architecture. This paper argues that surface design is not an exercise in superficiality, but in fact a necessary human expression with important social and cultural implications. What you read here is part of a larger research project which aims to explore some of these issues raised above.

Analysis: Surface

What do we mean by the term "surface"? The philosopher Avrum Stroll, offers four conceptions based on his analysis of everyday English language, which illuminates interesting clues about our common understanding of surface.[1] He offers the possibility of seeing surface as both a physical entity and an abstraction, without privileging either the outer surface or the inner substrate as primary.

Stroll uses geometry as an analogy for ordinary language in order to deduce common-sense "theorems" from words used in ordinary speech. He argues that this informal geometry of speech is "*deeper, more primitive, conceptually prior to, and indeed the basis for the refined and regimented mathematical and scientific treatments of geometric concepts,*"[2] of which one could mention the surface.

Stroll deduces that from the common-sense point of view certain entities do not have surfaces. Examples could be some physical phenomena: shadows, rainbows, lightening, and certain physical objects like clouds, dogs, plants, trees and persons.[3] Moreover, living beings cannot be said to have surfaces, but their skin can. Therefore, *"[t]he basic turf to which surface-talk applies is the world of the inanimate."*[4]

Putting aside these exceptions, Stroll deduces that surfaces can be categorised into two general conceptions: abstract and physical surfaces. In the abstract conception, surface is considered as an *interface*; a common boundary without divisible bulk that marks the theoretical distinction between two things, or a thing and nothingness.[5] In the physical conception however, surfaces have physical properties that include depth and divisible bulk. This conception is divided into two sub-categories: the ordinary person's observation [OS] and the scientific view as put forward by Gabor A. Somorjai [SS].

The ordinary person's view defines surface as part of the object - usually the upper or outer part - deep enough to become marked, scratched or scuffed. It has thickness and is also a boundary. According to this view, not only are surfaces identified with the outer aspects of solid objects, like homogeneous steel marbles, but they are also identified with such covering materials as paints, glosses or resins – and sometimes even with the patina that an object develops or acquires with time. In the scientific view however, surface is conceived physically as the last layer of atoms, before one moves to another medium. It is thus conceived as the progressive thinning of a material, moving from the centre to the boundary until the last layer of atoms is reached.

In our discussion of surface in architecture, it is the physical definitions that concern us the most, especially that of the ordinary person's point of view. This is because in most cases architecture is occupied and experienced by ordinary people and their definition of surface includes various physical properties related to the object. Moreover, from a ordinary person's point of view people have boundaries which mark them off from other entities in their environments but such boundaries are not surfaces. The human skin would be such a boundary, but it would not be a surface. Scientifically speaking however, skin becomes a person's surface.

We encounter a similar subtlety when discussing buildings. If buildings are said to have "skins," then according to the "common-sense point of view" they do not have surfaces; thus any operation performed on them is done on the *surfaces of the skin*. Thus, talking of architecture as having a metaphoric skin would result in a perceived conceptual separation between the operations performed on the surfaces of the building and the rest of the structure.[6] This is because from an ordinary person's point of view, skin is an organ of the body, separate from the rest of the organs. Moreover, skin can be detached from the body, but that is not the case with respect to surfaces of an object. The depth at which surface stops from an ordinary man's point of view is arbitrary and difficult to judge. Therefore, conceptually, the relationship between surfaces and the rest of the object is an inextricable one, as compared to skin, cladding or dressing and the body.

However, if buildings are thought to have surfaces then the relationship between deep structure and surface becomes direct and inseparable and therefore the operations performed on surfaces are no longer superficial, but rather *surficial*. Of course, many buildings are constructed with a skeletal frame onto which other architectural elements are hung. However, this does necessitate a comparison to the human body and skin, through which architectural surfaces become conceptually disparate and ultimately superficial to the act of building. If we see architecture as one conceptual entity then the separation between surface-play and formal structure would diminish. One way of doing this is to talk of surfaces of architecture, not skins or cladding; another would to be to see the entire building envelope as skin (or cladding).

The common-sense view of human skin and surface problematizes the effects of bodily metaphors on architectural design. Moreover, it highlights an artificial dichotomization that has persisted in architectural discourse. It is not so easy do determine where surface ends and depth begins. From this point of view, the superimposition of human metaphors onto architecture should be treated with caution, since they can result in a conceptual rift between the surface design and structural design, both of which are essential aspects of architectural design.

Dilemmas: Superficiality

In our current condition of increasing imagery, surface appearances and developments in new media, the question of superficiality is more significant than ever before. There are various reactions to the recent techno-culture: some are cynical and negative, whilst others attempt to engage with the current condition and draw out its potentialities.

In his book "*Simulacra and Simulation*", the French critical theorist Jean Baudrillard states that in modern society there has developed a condition of appearances without reference to any origin or reality, and not merely a separation from the real. He calls this condition a state of hyper-reality where truth and meaning is taken out of the equation and surface imagery operate independently.

With this view, Baudrillard sees images as "murderers" of the real; as perfect simulations with no reference to reality. This world of simulacra, he argues, results in a model of the universe not as a circle with a centre but as a "pure inflection or circular inflection." The flatland of periphery is not just dominant but it is everything; it *is* reality. Surface takes over essence whilst subjects and focal points disappear giving way to a superficial simulacrum.[7] In this worldview, God disappears and gives way to surface.

In another work entitled "*Seduction*" Baudrillard associates surfaces and appearances with the seduction of the "superficial abyss." He argues that seduction is a "game of surfaces" exploiting the charm and illusion of appearances and is therefore a passion for deviation and not a unilateral deliverance of truth.[8] For Baudrillard appearances are masks not of truth but of the fact that there is no truth.[9] For this reason he argues that we seek altered truths because they distract us from the ultimate truth: that there is none. This contradictory position of stating real truth as the absence of truth, demonstrates Baudrillard's dependence on the notion of truth, since he is ultimately fascinated by truth, be it what he calls the absence of it.

Nevertheless, Baudrillard argues that the world deprived of meaning comes to a state of pure periphery, a superficial state where the lack of an opposition creates the neutral and the indifferent.[10] He warns us that, in this world deprived of meaning what remains is only fascination of its "desert-like" indifference which eventually destroys us. This fascination is a nihilistic passion as he calls it "the passion proper to the mode of disappearance." If "seduction" is the passion attached to the world of appearances and "dialectical reason" to the world of meaning, then "*melancholic fascination*" is what grips us in the world of disappearance.[11]

Thus, surface in Baudrillard's viewpoint becomes a symbol for the superficial world; it is the empty void and the place where seduction occurs. Surface simulates depth - and everything else that we suppose as different from it. In Baudrillard's simulative theory, everything exists on the surface with the exclusion of meaning and truth, resulting in melancholic fascination and dominance of superficial seduction. His view of surface and appearances paints a bleak picture of our contemporary times.

One wonders however, whether there can be a more positive outlook. Can surface be seen in terms of a fusion of appearance and essence, a *chiaroscuro* made up of surface and significance? The French philosopher, Gilles Deleuze offers some useful theories.

In *The Fold: Leibniz and the Baroque,* Deleuze reconstructs Leibniz's Monadology through an architectural allegory of the Baroque house. He uses the term "fold" or *pli*, to describe the relationship between the metaphysical and the physical, between soul and the body, and between interior and the facade. The theoretical and architectural implications are numerous, however, what is of interest to us for the purpose of this paper, is an interpretation of surface which Deleuze's philosophy inspires.

Deleuze's theory offers a view of surface as a *connection* (rather than a separation) between essence and appearance. This connection and harmonization between the two worlds is inspired by the *fold* not just as an architectural feature of the Baroque but also as a concept and a *process*. The simultaneous separation and connection of the two worlds of the "high" and the "low," the "interior" and the "façade," is what constitutes the Deleuzian fold. Although these two worlds seem separate, they endlessly relate to each other. This infinite relation, and this impossible harmony is "*the fold that echoes itself from the two sides according to a different order.*"[12] According to Deleuze, the fold is like a chiaroscuro: the image is the product of light, emanating from the Monad who receives it from God.[13] As this light approaches the "dark

background" of matter, i.e. the continuous surface of the infinitely holey façade, "*the white is progressively shade, giving way to obscurity, to a thicker and thicker shadow.*" This is the basis of how Monads express themselves and as the very essence of the *fold*.

Thus, Deleuze attempts to theorize a condition whereby depth and surface co-exist in a smooth condition where the two are not so easily distinguishable from each other. In such a theory surface gives expression to depth through a never-ending harmony between essence and appearance. It is through surfaces that the Monad becomes expressive, and the two worlds of soul and body are bridged. In architecture this means surface design is not superficial, but in fact significant, spiritual and an essential expression of human intent. Surface is not deceitful nor is it meaningless, but both meaningful and honest. This honesty however, does not mark the end of the game or the absence of seduction, precisely because it is never clear: it is an honesty that marks the beginning of a creative process that leads to diverse interpretations.

In *The Fold*, Deleuze discusses the bridging of the two worlds through the writings of Leibniz and in relation to Baroque architecture. However, he acknowledges that this concept is applicable to other forms of expression, thus "the unfold" which is not contrary to the fold, but another condition of its manifestation. In this sense, Baroque architecture is not the only way of expressing the paradigm of the fold. This means that the importance lies in the translation of the paradigm into a physical manifestation where this manifestation is entirely dependent on the choice of the materials used. Different cultures have developed different manifestations of this paradigm thus releasing the forces of the soul from the prison of the infinite.

So the essence of the Baroque is "*neither falling into nor emerging from illusion but rather realizing something in illusion itself or of tying it to a spiritual presence that endows its spaces and fragments with a collective unity.*"[14] Here, illusion is not seen as negative or sign of a deceit, on the contrary, it is regarded as the nature of things. Therefore it is not nihilism or the death of meaning that is at work, rather faith in a spiritual presence that provides unity in the diversity of illusory surfaces.

As we discussed earlier, the distancing and detaching qualities of vision can result in a nihilistic attitude whereby the surface is reduced to an image, an illusion and a simulation. Contemporary architecture is also in danger of becoming trapped in the two-dimensionality of the image and the spectacle. Yet an architecture of surface is possible which is not superficial, and is more than the superficial seduction of appearances. This architecture requires a positive and exploratory attitude towards surfaces.

The fold or the unfold as paradigms, allow a diversity of architectural expressions which are united in their essence. Consequently surface is significant, not because it *pretends* to be true, nor because there is nothing but the "superficial abyss," but rather because the surface is a connection and not a separation between appearance and essence. Surface embodies the ideas of both worlds and it is a place of becoming, where becoming is more than the sum of its parts.

This way there is no nostalgia for truth, instead there is the possibility of a game, a seduction of life and creation rather than death and melancholia.

Precedent: Theory
Amongst many who have advocated surface play in architecture, the theoretical work of Gottfried Semper has been deeply influential for the formulation of architectural metaphors and ideas in twentieth century architecture. Semper (1803-1879) was an architect and a theoretician who formulated his ideas in nineteenth century Europe when developments in archaeology, ethnography and philology had revealed new facts about the art of the ancients. He was very much interested in the essence of architectural creation which he thought was shared between different cultures and styles. Being poised between the traditional architecture of "poets" and the industrial architecture of the "polytechnicians,"[15] Semper sought to understand the essence of architecture in order to reconcile the differing viewpoints and practices with each other.

In his quest for the origins of architecture, Semper based his theory on a Caribbean hut in the "The Great Exhibition" from which he concluded that architecture was made up of four irreducible elements: the hearth, the enclosure, the roof and the terrace. These four elements corresponded to four ways of making: moulding for the hearth, weaving and plaiting for the

walls, carpentry and joinery for the terrace and the roof, to which was added stereotomy, or masonry. Semper's complete theory of origins need not concern us here, but what is important about his view, is his theory of enclosure (the wall) to which he devoted more elaboration than any other "element" of architecture.

Relying on ethnographic accounts, Semper argued that the invention of woven mats hung vertically to create enclosure came before clothing.[16] With this statement, he not only emphasised the development of textiles as more than a technique to cover the body, but also argued that the colourful woven surface - not the structure on which it was hung - marked the very essence of architecture: "…*the beginning of building coincides with the beginning of textiles.*"[17] As a result the structure that served to hold, secure or support this spatial enclosure was for Semper, a secondary element in relation to space or the division of space and therefore foreign to the original architectural idea and never a form-determining element.

The newly discovered Assyrian alabaster bas-reliefs were also key components in Semper's theory, since the figures chiselled in the gypsum he argued, imitated the style of the textile dressings that preceded them. Such a reading allowed Semper to conclude that the Oriental system of weaving and polychromy was the inspiration for the painting of walls in Greece. With this, Semper posited a radical theory that Greek polychromy found its historical genesis and meaning in the primal act of carpet making, the art of the "wall fitter".[18] Thus, for Semper, the perfection of the wall as an element (idea or motive) of architecture, took place in ancient Assyria and Persia, cultures that were famed for their colourful tapestries. But more importantly, Semper proposed a theory of architecture in which ornament and surface-play was seen as the essential act of architectural creation and an important aspect of human and social expression, rather than a secondary act of frivolous superficiality.[19]

Outlook: Re-Surfacing

According to the *Metapolis Dictionary of Advanced Architecture*: "*Today it is a question of constructing surfaces under the sky rather than volumes under the sun.*"[20] With new design and manufacturing techniques, emphasis in architecture is shifting towards the generation of complex surfaces, rather than the assemblage of pre-fabricated objects. Complex geometries modelled in the virtual space of the computer are translated into material shells that house overlapping programmes. Moreover, new technologies of screens, automated construction machines and lighter and cheaper composite materials, have allowed surface-play to become more economically viable.

The architecture of early twentieth century, governed by post-war demands for mass housing, advances in steel construction and the necessity to clad these materials efficiently, problematised the relationship between ornament and structure, surface design and structural necessity. The white paint of the International Style as well as the modernist theories of Adolf Loos, Mies van der Rohe and others, condemned surface-play to frivolity and excess. As a result, colour, pattern and surface communication was limited to the vocabulary of the materials used, as anything else would have been considered to distract the viewer from "pure form." Thus, monochromy, surface simplicity, and structural honesty was given priority to polychromy, ornament, and surface communication.

Postmodernists like Robert Venturi attempted to break away from the austerity of the International Style. Venturi's famous counter-quote to Mies's "Less is more" with "Less is a bore," sought to reintroduce diversity and complexity into the architectural practice. He asserted that most modernist buildings are "ducks", i.e. buildings in which the symbolic form is the organising principle of structure, volume and programme. What he proposed as a way forward was a "decorated shed" in which the shelter is dictated by utilitarian considerations, while the symbolic bits and pieces are stuck on to the front: facades, billboards or signs.[21]

This was a step towards the reintegration of surface-play in architecture, but ornament in this arrangement did not become "woven" into the design process, as Semper had spoken of. The result was a deepening of the divide between surface design and the design of structure, where each became more intense in their own separate conditions. In this form, surface design was still a superficial act.

Recently however, the changing nature of capitalism and the introduction of new digital design tools have enabled architects to introduce new design processes into their work. Moreover, developments in construction techniques and materials have allowed complex forms and surfaces to be manufactured quickly and easily without compromising structural stability. Much of contemporary computer modelling used to design

buildings, are surface-driven, i.e. volumes are created using virtual surfaces to which colour, pattern and materiality is added. The result is a process akin to the weaving of carpets, in that it is the construction of a "plane" (expanse or surface), which is then used to generate architectural space. This is rather different to designing structural elements, which then have to be connected and completed using a filler, a skin or cladding. This change in the design process should allow for a renewed sensitivity to the potential of surface communication (and surface design) in architecture. After all, we experience space through the surfaces that delimit it.

Such new design techniques have resulted in new architectural production. 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 complex surfaces using Metaballs of differing mass and attraction, which can be connected together to create complex forms and surfaces. The ability of the computer to plot out these complex surfaces and its ability to reproduce them using automated construction machines, has allowed architects to exercise more play in the generation of surfaces and forms in architecture. Furthermore, often the necessities of construction result in an increased sense of rhythm and ornamental complexity. Elaborate topologies are often triangulated creating shimmering surfaces, whilst new materials like Electronic Paper Displays, LEDs, composite polymers, printed glass, and new composite metals bring the surfaces of architecture to life.[22] The opportunities for exploration are many, but as always architecture compared to other construction industries (like the automobile industry) is slow to exploit the potential of new ways of building.

It is important to see architecture as one conceptual entity, as a thick surface condition that delimits space. Fortunately architects are beginning to challenge the conventional categorisation of architecture into surface and structure by infusing the two together. Los Angeles-based Peter Testa Architects have proposed the *Carbon Tower* project, a forty-storey high-rise prototype, that 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 colours of metals, or even fibre-optics into the walls of this building, thus allowing surface-play to become literally "woven" into the design process.

Conclusion

In most instances, our first contact with a building is a visual one involving the surfaces of architecture. We are increasingly surrounded by architectural surfaces that talk to the eyes. In this ocular relationship there is a danger of treating surfaces as detached from reality and essence and surface-play as deceitful; a "game of death" and a seduction of the "superficial abyss." However a more positive approach is possible which sees surfaces as a bridge between the worlds of appearance and content. Surface can be the modern "unfold", not only an architectural feature of our current condition, but also a process, a *surfacing* of meaning and essence.

This is not a new development in architecture. Throughout history, architectural surfaces have been canvases that have carried stories, histories and symbolic meaning. This surface-play, Semper argued, had its roots in the colourful woven textiles, which later developed into other materials such as stucco work, or mosaics.

From an ordinary person's point of view, buildings have surfaces not skins, which ensures a more homogeneous relationship between what appears on the outside and what remains beyond this surface layer. If we regard architecture to be one conceptual entity then surface and structure become interwoven and the division between the two becomes at best arbitrary. From this point of view, operations performed on the surfaces of buildings are not superficial, but *surficial*. As a result surface design becomes infused with the very nature of architecture rather than an act only concerned with the outer element, which can be peeled away to reveal the true inner essence. Surface and surface design thus, become part of the very essence of wall construction and therefore architecture.

Contemporary architecture is returning to an appreciation of surface design, as practiced by the builders of the past. Recent developments in computer modelling, new construction techniques and new materials have allowed surface-play to become

infused with the design process. Surfaces are places of communication and exchange, and the operations performed on them are essential acts of architectural creation. Conceptually, surfaces are inextricably tied to the rest of the structure, even though physically, it might be possible to separate the two.

NOTES

[1] It is worth noting that we are operating within the realm of the English language and thus the theorems deducted are specific to this language. It would be interesting and perhaps important to investigate the meaning of surfaces in other languages which will differ to English. But, for now, we shall accept the limits of our study.

[2] Avrum Stroll, *Surfaces*. Minneapolis: University of Minnesota Press, 1988, p. 12

[3] For example, it would be odd to say that a shadow has a surface and for the case of living human beings, one might touch someone's skin or hair but one cannot be said to be touching their surface.

[4] Stroll, *Surfaces*, p. 27

[5] Abstract surfaces are further divided into the "LS conception" and the "DS conception" the latter acquiring some of the attributes of the physical object.

[6] This conceptual separation of surface from the rest of the building object holds true for metaphors of "cladding" and "clothing."

[7] Jean Baudrillard, and Shiela Faria Glaser, *Simulacra and Simulation, Body, in Theory*. Ann Arbor: University of Michigan Press, 1994, p. 29

[8] Jean Baudrillard, *Seduction, Culture Texts*. Basingstoke: Macmillan Education, 1990, p. 53

[9] "One need not want to dispel appearances (the seduction of images). But if one does, it is imperative that one not succeed lest the absence of the truth become manifest." Baudrillard, *Seduction*, p. 59

[10] Ibid. p. 160

[11] Ibid. p. 160

[12] Ibid. p. 29

[13] Gilles Deleuze, *The Fold: Leibniz and the Baroque*. London: Athlone, 1993, p. 32

[14] Ibid. p.125.

[15] In Rykwert's words young artists in the nineteenth century were gradually moving away from their guilds and assembling in academies, but more importantly, in schools, the artists "*shifted their attention from creating objects intended to edify, move or excite the spectator, and concentrated on an authentic expression of individual vision, in which the artist's relation to the spectator through the object became increasingly less important…*"[16] Thus, architects separated into the two groups of the "poets" and the "Polytechnicians" who developed different understandings of beauty and decoration. Joseph, Rykwert, "Ornament is no Crime" in *The Necessity of Artifice, Ideas in Architecture.* London: Academy Eds., 1982, p.93

[17] In his own words, *"[t]he art of dressing the body's nakedness (if we do not count the ornamental painting of one's own skin discussed above) is probably a later invention than the use of coverings for encampments and spatial enclosures."* Gottfried Semper, "The Most Primitive Formal Principle in Architecture Based on the Concept of Space and Independent of Construction. The Masking of Reality in the Arts." in *The Four Elements of Architecture and Other Writings*, Cambridge: Cambridge University Press, 1989, p. 254

[18] Ibid.

[19] Ibid. p. 258.

[20] However, he was against false pretence and did not approve of making materials look like other materials. For him, honesty to materials and their statical laws was paramount, yet, it did not stop the surface-play with colour and pattern: *"Brick should appear as brick, wood as wood, iron as iron, each according to its own statical laws. This is the true simplicity on which we can let our fondness for the harmless embroidery of decoration run free. Wood, iron, and every metal need a coating to protect them against the corroding effects of the air. This need can be fulfilled quite naturally, in a way that contributes at the same time to their embellishment. Instead of a dull coat of paint we could select a pleasant diversity of colour. Polychromy thus becomes natural and necessary."* Gottfried Semper, "Preliminary Remarks on Polychrome Architecture and Sculpture in Antiquity (1834)" in *The Four Elements of Architecture and Other Writings*, Cambridge: Cambridge University Press, 1989, p. 48.

[21] Manuel Gausa, *The Metapolis Dictionary of Advanced Architecture*, Barcelona: ACTAR, 2003

[22] See Robert Venturi (New York N.Y.). *Complexity and Contradiction in Architecture*. 2nd ed. London: Architectural Press, 1977 and Robert Venturi, Denise Scott Brown, and Steven Izenour. *Learning from Las Vegas: The Forgotten Symbolism of Architectural Form.* Cambridge, Mass.: MIT Press, 1977.

[23] Some projects worthy of mention are dECOi's Aegis Hyposurface which demonstrates a close relationship between software and hardware, harmonised to create a robotic skin/wall that is capable of reacting to its environment. NOX Architect's Water Pavilion is a good example of creating complex curved surfaces for both the interior and the exterior of the building, and finally Frank Gehry's Disney Concert Hall demonstrates the ability of new digital technologies to map complex surfaces (from a maquette or a model) and translate them to real size architectural components which can be assembled to create a building.