DIGITAL CONCEPTION(S)

Architectural concepts of digital design and making

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Abstract. This paper presents an investigation of probative works of architectural thought and production executed in various forms of digital design and computational media. The applied design research focuses on an examination of the procedure or process constructed to both develop exact, precise digital models and constructed processes that result in design outcomes that cannot be pre-visioned. The changing position of the conceptualisation within the design process continually changes the relationship of the digital work and the computational framework. The work challenges one to interpret design processes of translation and transformation, through the continual oscillation between developed in pursuit of known results and constructed methods for making, in an effort to unravel the pretext of the singular point of view to reveal the intention of the design conception(s). The projects discussed here focus on relationships between the projection of space in architectural representation and the production of architectural form through complex geometries relative to discontinuities and the way in which they agitate and alter one another. DIGITAL conception(s) operate across three primary areas of research; animation, conceptualisation and fabrication. The work oscillates between digital and physical artefacts that intertwine digital/physical workflows while simultaneously engaging temporal issues of time based media through motion graphics and animate constructs.

Keywords. Design representation; visualisation; design theory.

1. Introduction

Digital craft engages both issues of design representation and design process. The DIGITAL conception(s) research conducted focused on probative works
of architectural thought and production executed in various forms of digital design and computational media. This applied design research was conducted by undergraduate and graduate students of architecture in and beyond my advanced computer applications in architecture seminar and aesthetics|media|politics studio over the past several years. The ideas and conversations that began in the seminar and studio have developed to broad reaching collateral effects (academic papers, design awards, prizes and honours) beyond their modest beginnings. The ideas and concepts promoted and interrogated throughout the projects are designed to develop and hone critical design thinking skills in the pursuit of multiplicitous conception(s) of architecture.

The works represent an ongoing dialog between the students, and myself, but more importantly they are the manifestation of meaningful interaction between the students and their ideas. The interaction of the two, moving in seemingly unorthodox ways to test and probe the digital design concepts and digital media techniques, allow for a deeper comprehension of architectural space and form. DIGITAL conception(s) operate across three primary areas of research; animation, conceptualisation and fabrication. The work oscillates between digital and physical artefacts that intertwine digital/physical workflows while simultaneously engaging temporal issues of time based media through motion graphics and animate constructs. The boundaries and interpenetrations between the areas of work are frequently blurred, as the conceptualisation of architecture is often a messy business.

The most common preconception related to this work is that digital design processes, forms and aesthetics are free from a historical context or value system. In DIGITAL conception(s) the opposite is true. In fact, most of the digital processes and techniques explored here are intimately linked through a deep and long-standing tradition in architecture to seek clarity of architectural thought through artistic and scientific examinations of the theories, ideas and concepts that drive one’s architectural preoccupations. According to Le Corbusier it was the modular, mathematics and purist painting that were the empirical research that drove his architecture. His research practice entailed the pursuit of both the computational and expressive sides of his mind simultaneous with his architecture.

Through the work in this research, students have found themselves emancipated from the narrow definitions of common preconceptions and misconceptions of digital design media. This work demonstrates many re-conceptions of the medium and the architectural design process. The projects are driven by an interest in developing a range of design solutions rather than fixating on the pursuit of a singular solution to a given design problem, privileging process over product. The projects have introduced the students to the ability to
manipulate information and computational systems as design tools that operate within the design and conceptualisation of architecture. The task is to develop a thorough understanding of how changes in design technologies, such as animation, parametric modelling, scripting, and digital fabrication serve to provoke a reinterpretation of the design of architectural form and space.

The tradition(s) of exposing architectural ideas through the rigorous research of recombinant geometries, narrative systems, and the art and craft of making are deeply held value systems that bind this work. Through the immersive engagement of the tools, techniques and processes of digital media, several misconceptions are revealed, repaired and removed. The challenge is to understand the opportunities presented when digitally driven design, process and production technologies are envisaged more comprehensively than as mere tools to fully embrace them as ways of thinking in and of themselves.

Through this ongoing work I am constantly challenged to facilitate re-conceptions in the evolution of the students and myself. This collaborative enterprise is imbued throughout my teaching, research and creative practices that are affected and emboldened by students’ creative discoveries, technical obstacles and breakthrough moments.

2. Animation – spatial/temporal sequences

In the essay, Body Matters, Greg Lynn discusses the changing attitudes towards the geometric description of the human body and the corporeal metaphor in architecture (Lynn 1998). He proposes that our historical use of geometric descriptions of the ideal human form as an architectural language is lacking a relationship to our reality because they lack specificity and definition of bodies in time or space. If the body is conceived not just in space but also in time than the ability to reinterpret the body and its dynamic motion as the corporeal metaphor, engaged not as a static condition, but as a dynamic event. Abstraction and mathematical manipulations of proportion and scale are means to project boundaries through derived lines of profile and contour. The intention of this phase of the project is to develop a broader understanding of line by studying the relationship between profile and contour as both analytic and generative operations that must undergo a subsequent transformation to be realised as architecture. The assignment is to examine the relationship between human scale and metaphysical simultaneity, examining the ways in which ambiguities can provide organisational models for design.

Lines can be produced simultaneously as profile and contour through displacements of the point of view as degrees of intensity located along the continuity of space/time. In this study, we will develop an understanding of the potential relationships between the human body and architecture, a physical
metaphor of architectural assembly and as an experiential phenomenon of the living/perceiving body in space. This relationship demands of us the recognition of the necessary alignment or resonance between architecture’s physical and mental constructs.

Animation is an extensive matrix of physical, spatial, visual and temporal forces. Animation is not just a process to be executed, rather an opportunity to derive and communicate meaning through the re-presentation of still images in a constructed sequence to imply or simulate motion. Animation and a cinematic approach to analysis of space and form through time can have a significant role in the generation of architecture and architectural inquiry and as such, has a significant role in the structuring of the architectural design process.

Animation is a process of projection, evaluation and ultimately speculation. Animation is a virtual approximation of the real, it is an illusion of motion virtually projected through the sequential re-presentation of the many as a singular motion graphic. Animation and the spatial/temporal modelling of a cinematic construct is a synthetic description of space-time that simultaneously engages techniques of analysis and re-presentation. This group project will employ two modes of investigation to develop an interpretation, a virtual projection of time and space, surface and depth. Animation and modelling as act, process, and product serve as the modes of investigation. The first animated flipbooks and films were created at the turn of the 19th century. The fundamental principle and techniques of animation today were derived in the early part of the 20th century and perfected in the hand-drawn cartoon animations of the 1930’s. In animation the illusion of movement is achieved by the rapid re-presentation of many still images in sequence. At the core of all animation is the principle that a sequence of still images re-presented through time can communicate a singular simultaneous view of the multiplicity of the images. From the earliest cell animations to the latest CGI effects all animation depends
on the composition of the still image in time. The spatial consequences of this means of representation are shown in Figure 1. In this example, a singular geometric construct is interrogated through a series of animated transformation. The geometry is transformed with each subsequent animate series. The work results in a matrix analysis of each developed sequence of translation.

3. Conceptualisation – rigorous geometries

“To disclose appropriate alternatives to the ideological stagnation plaguing most architectural creation at the end of the second millennium, the first crucial step is to acknowledge that the value-laden tools of representation underlie the conception and realization of architecture.”

– Alberto Pérez-Gómez,
Architectural Representation and the Perspective Hinge (1997)

Digital design technologies such as CAD, BIM, parametric, generative modelling applications, and fabrication are not tools, but instead propose ways of thinking, conceptual positions, to frame the work conducted in these media processes. This project will focus on a relationship between the projection of space in architectural representation and the production of space through complex geometries relative to temporal discontinuities and the way in which they agitate and alter one another. The motive is to bring about conflicts, identify problems to solve and to resolve the resultant disconnect in such a way that it brings about unanticipated forms, temporal experiences and patterns of spatial inhabitation and formal production. The example given in Figure 2 demonstrates the conceptualisation and development of a range of rigorous geometries. Each element in this study constitutes a singular event or configuration complete in itself, but forming part of the larger collection. It is the referential condition, the delta between, which is modelled and transformed to suggest various and multiple geometric definitions with respect to the formal and spatial portrayal through the composition of time, light, shadow and the conceptual framework. The capacity to represent or re-present spatial compositions is a unique skill and a primary task of the architect.

The function of architectural representation goes beyond the description of existing or future buildings to the conceptual and literal communication of meaning and intent. While most conventions of architectural representation and communication have implicit limitations in their capacity to represent architectural space, many reveal some of architecture’s latent possibilities. Digital representation, with its own set of limitations, has the potential to liberate and provoke possibilities in architectural design and representa-
tion simultaneously by configuring new representational conventions. One of these is the prospect of animate, spatial description. Another is time and the fracture of spatial sequence through temporal isolation. All modes of architectural representation, however limiting and/or revealing, are as essential in the creative process of architectural design, as they are necessary in the production of building. Implicit in an architect’s ability to project spatial and formal compositions, is the capacity to describe them by challenging representational conventions and other architectural forms of representation. In this sense, the work of the architect could be defined as the task of anticipation of space in time through the construction of representation.

Figure 2. Translation of geometries (student work: Jonathan Healey).

The sectional implications of the cinematic or animate models recompile the analytic in a synthetic fashion. The proportions, scales, volumes and figural organisations found within the constructs generated suggest potential interpretations of spatial/temporal organisations and descriptive systems that project surface/depth. The work seeks to analyse and interpret the visual artefacts created through a series of images (2D & 3D & 4D) that investigate the organisational systems and hierarchies of the work in question. The goal is to reveal the ideas of scale and proportion embedded in the work through a series of sectional images that seek to describe the architectural (spatial) significance or potential of the forms. All attempts are made to expose the spatial implications inherent in the work. The intention is to dissect the work into its constituent parts then recombine them through a synthetic act to re-design an abstract interpretation of the collective understanding of the whole.
4. Fabrication – digital/physical workflows

“...witness extraordinary spatial and formal manipulations clad in metal panels that are rendered indifferent to the very geometries and spatial constructs to which they are meant to correspond. ...[attempt] to overturn this dichotomy and to create a condition whereby surface and space are understood as organically linked, with geometry and patterning as the agencies for their precise resolution.”

–Monica Ponce de Leon & Nader Tehrani, Versioning (1995)

To develop a broader understanding of digital fabrication, as a means of conception the challenge is to understand the opportunities presented when digitally driven design, process and production technologies are envisaged more comprehensively than as mere tools (Kolarevic 2003) to fully embrace them as ways of thinking in and of themselves. One of the dilemmas of tool thinking is that it undermines the additive value of skills and intentions working together when conceptualised as a working methodology with its own rules and boundaries to be played within and against. A tool, such as a chisel, provides one way to remove material. As a tool of removal, a chisel is limiting. Digital fabrication is not a tool, but a way of thinking, a conceptual position that frames the way one operates within architectural design. Digital fabrication is not the chisel, not a tool, but, more precisely, it is the concept of removal that the chisel represents. Understanding and positioning fabrication as an engaged process or method of design and a way of thinking is far more powerful than limiting it as a tool. Understood as a progressive process of reiterative learning it can be developed and dissected into and throughout a curricular structure. Students must understand not only the model geometry but also the implications of the ways the model is constructed and conceived to develop a rigorous process of critical evaluation to understand the elements not only through convention but also design intent. Moving beyond tool thinking to that of a method, we can study the relationship between digital and physical workflows as both analytic and generative operations that must undergo a subsequent transformation to be realised as architecture. The assignment is to examine the relationship between the digital and the physical, examining the ways in which ambiguities can provide organisational models for design. The geometric development of physical artefacts can be seen as a process of description, communication and ultimately speculation. Void can be seen as the absence of description and communication that ultimately begs interpretation.

The intent is to conjure a reading of both the experiential, felt presence of motion and an external condition, which consequently destabilises the singular vantage points of the original referents. The hybrid images/animations
utilise hand drawing, modelling, photography, scanning and digital transformations to explore serial composition, repetition and/or extension. Figure 3 is an example of the physical construct that goes beyond the digital conception of its fabrication. Each layer of the laser cut acrylic model is etched and cut from both sides of one-inch thick Plexiglas. The literal and phenomenal transparencies developed in this artefact produced an emergent morphology of line, shape, structure and depth. The examination of the procedure or process constructed by the computational design process should be understood as the connection or relationship of several components in a particular sequence to tell a story of form, space and time. An action is choreographed through/against a context which conceptually reveals the space, and registers movement through time.

![Figure 3. Morphological sequence study (student work: Jimena Amaral).](image)

5. (Dis)assembly

"Contemporary techniques thus constitute the beginning, and the end, of the loop, which is perpetuated and proliferated by technology. This proliferation is contingent on an understanding of technology activated within its cultural context. The interaction between technology and the user creates the possibility for qualitative cultural transformation through the transmission of behaviors that are replicated."


Sectioning space and time to reveal analytic and synthetic relationships found in the modelling and representation is the objective of this phase of the project. The animated path around, in and through the model may be broken down into constituent parts and re-complied through spliced animation and/or it can be temporally sectioned and revealed through the motion of the view point through time and space.

The objective is to simultaneously express time and space an analytic/syn-
thetic engagement of surface and depth. Create an animation of a model that demonstrates a thorough investigation of surface and depth expressed through sectional understandings of the modelling construct. The animation should endeavour to re-present the spatiality of the constructed geometry represented through motion. Spatial relationships found within the form itself and in the process of its representation are fundamental to the exploration both as an analytic device and synthetic technique. Use of spatial motion and temporal displacement of the modelled surface are encouraged to re-present the model in a meaningful way. The constructed morphology results in a surface study that of a new recombinant sequence(s) constructing the space and time of the previous interpretation.

This project focuses on the production of a physical spatial object/surface that is the morphological extension of the procedural operations. Time and space through motion and image are interconnected in both film and architecture. Sequence and didactic systems of representation are fundamental to both areas of design research. This project asks the student to consider how a sequence might be taken apart and recompiled in a new way that is critical and creative with the assemble-deconstruct-reassemble workflow.

6. Conclusion

The project discussed here focuses on a relationship between the projection of space in architectural representation and the production of space through complex geometries relative to temporal discontinuities and the way in which they agitate and alter one another. The projects are driven by an interest in developing a range of design solutions rather than fixating on the pursuit of a singular solution to a given design problem, privileging process over product. The projects have introduced the students to the ability to manipulate informa-
tion and computational systems as design tools that operate within the design and conceptualisation of architecture. The task is to develop a thorough understanding of how changes in design technologies, such as animation, parametrics, scripting, and digital fabrication serve to provoke a reinterpretation of the design of architectural form and space.

References


