Models of / Models for Architecture

Physical and Digital Modelling in Early Design Stages

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Abstract: This paper questions whether physical and digital models can be seen as models for rather than models of architecture. Stressing the mediated nature of the design process, it questions the role models play in the early stage of architectural design. This research draws from an experimental digital & physical modelling workshop. The conclusion argues for a modelling process that incorporates both physical and digital modelling, and acknowledges the mediated nature of the design process.

Keywords: Modelling; digital; physical.

Models of / models for

A model - in the largest sense - makes complex realities comprehensible, operational and workable. By selectively reducing complexity, focusing on certain aspects, altering scale, adding colouration etc, the model can be seen as lens through which a reality is interpreted and represented. A model can also act as an exploratory device, it allows new questions to be raised, hypotheses to be formulated, alternative solutions to be explored.

Models capture ideas, concepts, realities in a representation system, that is inextricable connected to the use of this model. When we use the term model in this paper we refer to both this system of representation and the concepts they represent.

This notion of the model - mental construct and a system of representations – can be found in many fields of human activity. In scientific research a model is considered sound if reproducible under controlled circumstances, independent of the individual researcher. In design models play a different but equally important role: design by definition deals with the new, the non-existing, so the model can be used as the basis of conceptualizing, communicating, assessing, and realizing the design intentions.

Ranulph Glanville characterizes this difference with the notions of models of and models for (Authors notes of keynote lecture at eCAADe conference in Antwerp (2008): Scientific research produces models of, knowledge of the world, while design is concerned with making models for a (better) world. Science is foremost interested in the world as it is while design is interested in the world as it could be. Glanville goes on to suggest that computer aided modelling is trapped in making models of architecture and does not succeed providing models for architecture.

Models of can be qualified as interpretative, whereas models for could be seen as explorative. Translating this to the everyday practice of model making in architecture this paper asks to what extent can physical and digital modelling techniques be described as models for architecture? Is there a difference in mediation between physical and digital...
modelling process? Does a design process benefit from a hybrid form of modelling, incorporating both physical and digital modelling?

**Representation and mediation**

Architecture is out of necessity a mediated activity: in order to be realized, the architectural artefact and the concepts behind it, are represented in other media first: sketches, perspective drawings, plans, sections, diagrams, spreadsheets, text, physical or digital scale models.

These representations are not only instrumental in communicating architectural concepts with other stakeholders in the building process, but play an active role in the architectural design activity itself. Representations, allow the designer to communicate with herself. The design process can be described as a gradual shaping of a design concept through an iterative cycle of representation and interpretation.

The media used in the design are not neutral containers of design ideas, they have a logic of their own, some ideas are easily represented in certain media, while others will find resistance. Mediation acknowledges this idea of the ‘guilty medium’, the medium we use to design will influence the design process. The degree of mediation depends on the skill of the designer, the characteristics of the medium, directness and length of the cycle of representation and interpretation.

Translating the theoretical framework sketched in the introduction to the field of architectural practice, we can say that models of corresponds with the presentation model made after designing, while models for correspond to the working model or sketch model, made while designing.

Presentation models are a very effective form of architectural representation, especially in communicating a finished design project. While other forms of architectural documents are often hard to interpret, for people without an architectural education, presentation models seem to be comprehensible to a larger audience.

Working models, sketch models or *dog models*, like the initial design doodle, are seldom made public. They are made with no other purpose then testing a certain design issue. Sketch models, whether digital or physical, are made during the early stages of a design process, they are part of this iterative process of representation and interpretation.

Both working models and presentation models are forms of representation and thus introduce mediation. The impact of mediation in working models goes deeper as it is not limited to the communicating of a design in a later state, but it shapes the design in early stages of the design process.

**Physical and digital model making**

In the field of design research, model making did not receive as much attention as sketching and drawing, and was considered of peripheral importance at best (Ostwald, in Downton 2007). Recently we have seen a renewed interest in physical model making both in academia and practice, in publications and exhibitions. This comes not coincidentally at a moment where the digital is going beyond the virtual and reaching out into the physical domain of fabrication and construction. Within the extensive field of digital design enquiry, that emerges from academia, architectural offices, design consultants, specialist groups and user communities on forums and blogs, we see a renewed interest in physical form finding.

Digital modelling has developed over the last decades to a series of tools that includes all stages of design: from surveying, sketch design, structural engineering, to realization and beyond. It has developed from mimicking analogue drawing and modelling to a process that uses the computer as a design tool in its own right, as is seen in parametric, algorithmic and generative modelling. Digital modelling allows the creation of precise, detailed, controllable, geometrically complex models, which are easily reproducible, easily reconfigured, and which allows different variations of design to be explored.
Digital modelling has its limitations: it lacks directness and intuitiveness, notwithstanding the research that has been done in improving human-computer-interface. The lack of directness is strengthened by reduction of 3D geometry to a 2D screen. Most computer modelling software tries to counter this dimensional reduction through navigating the view through and around the model and providing multiple views at once. As such digital modelling reinstates the monocular reduction of linear perspective, but tries to overcome this by animating it and rendering multiple views at once.

The advantages of physical modelling lie in its materiality, its tactility, the way it is perceived visually, and can be manipulated directly. Physical models can vary in application, scale, materials and use. A physical model does not show a similar dimensional shift as drawings or models on a computer screen - i.e. a physical 3D artefact represents another 3D artefact. But this does not imply a direct translation from what is represented to the model. Furthermore models aren’t limited to representing artefacts, models can diagrammatically reveal otherwise hidden aspects of an artefact, or can represent a pure idea, concept or even feeling. Perception of a physical model goes beyond the visual: texture, weight, balance, resistance of materials. Depending on the scale of the model visual perception is limited to an exterior overview.

The materiality of the physical model implies skills in making and a logic of construction – even in a conceptual model a piece of cardboard will not hover in thin air. The material nature of a physical model makes it hard to reproduce. It takes time.
ModelingLAB – agile design as method

To develop this research a physical & digital modelling workshop was set-up as an elective course open to architecture and interior architecture students in the second bachelor of Sint-Lucas Architectuur, Ghent. In this we followed the ideas of an agile design (http://agilemanifesto.org/): Focusing on small, protoarchitectural sub-assignments, both limited in scope and time. It took the form series of intensive workshops, in which we strongly encouraged a learning by doing approach.

Students were asked to design an exhibition pavilion within the school's courtyard by modelling directly in 3D (both physical and digital). We limited the programmatic scope of the design, so students could freely explore physical / digital modelling to build, so variations are more difficult to explore. Mark Burry sees this slowness as positive, and states that this reflective moment is missing in digital modelling (in Downton 2007).

With the maturing of digital design modelling, the advent of rapid prototyping and digital fabrication on the one hand, photometry and 3D scanning on the other, we could question the use of dividing architectural representation into digital and physical, 'virtual' and 'real'. [Holzer 2008] This research explores a design process that embraces a multitude of representational modes. This could be a hybrid form modelling that integrates the physical and the digital – digitally augmented physical models or physically aware digital models for example. Or it could be a design process that sequentially alters between different modes of representation.
as a design tool, and be conscious of their design decisions.

Each workshop started with a theoretical introduction followed by an exercise that needed to be completed within a short time span. The first four weeks were focused on individual experiment with both physical and digital modelling techniques, the last four to integrating different techniques and finalizing the design, in groups of four students. Students kept a weblog, in which the different techniques used and crucial steps in the design process where documented.

It is important to note the difference between the use of models in the academic design studio and in the architectural practice. In the latter models are seldom made by the lead designer, so although models might be crucial for the development of design ideas, a second degree of mediation is introduced. The model becomes a communication device in a collaborative design process. In the first four weeks of our case study, through individual hands on experiment, the students where both maker and designer, where models could really become part of an introspective process (Figure 1). While in the last four weeks the model was part of the collaborative design process (Figure 2).

Conclusions

From the weblog, the final design outcomes, and a questionnaire filled out by the students after the workshop, we saw that both digital and physical have the potential of becoming models for, rather than models of architecture. On the one hand we saw that most students preferred using physical modelling as a quick sketch exploration, on the other students expressed a growing fascination and enthusiasm for digital modelling.

Students experimented more freely with physical modelling, resulting in a large variety of materials and modelling techniques - clay, meshing, paper, glue, foam, wire, Perspex to name a few. Digital modelling requires a set of concepts an processes to be learned, making a lot of students stick to the examples and tutorials before they could explore more freely. Making digital and physical models next to each other and explicating similarities and differences helped to introduce more abstract elements of digital modelling.

We identify two characteristics of models for architecture as exemplified by physical model making: models must have a degree of unfinshedness, a suggestive indeterminacy and allow for reflection:

Physical sketch models have a degree of unfinshedness, allow exploration of - and even inspire - alternative design outcomes. As Michael Ostwald (in Downton 2007) writes: “Architectural models must remain expendable, ignoble objects for them to be useful. This does not limit them; on the contrary it is their natural state and their particular strength”.

Digital modelling to a degree, shows this easy to transformable nature, endless variations can be made through manipulation of geometric entities. In many contemporary modelling software, ‘visual styles’ are used to make models look less finished, more suggestive and ‘sketchy’. Parametric, associative modelling, allows for a construction of ‘working’ models that explicitly define geometric constrains and relations and allow different design solutions to be explored by varying parameters. The solution space in which one operates is limited and the terms in which one explores are defined beforehand. Whereas physical modelling allows an open-ended exploration of design ideas, introducing elements such as chance and serendipity, digital exportation even in parametric modelling is deterministic in nature. It is not so much the degree of mediation that is differing, but the nature of mediation.

The relative slowness of physical modelling, gives space for reflection, making design changes while the model is being constructed. In that perspective rapid prototyping, and a file to factory fabrication, might be either too fast, not allowing a moment for reflection or not fast enough: Depending on technology (SLS, SLA, etc) and the size, printing a typical architectural model, takes a few hours.
Reducing this to a few minutes or seconds or even an instant physical output of our digital model, the representation, interpretation cycle could be restored.

When digital fabrication techniques become mundane enough, when the fascination or even adoration will have vanished a truly explorative and fuzzy use of these techniques becomes possible. A first step towards modelling for architecture might be raising awareness that design is a mediated process, that media kick back and developing an explorative approach that consciously alters between different representational modes.

A modelling approach that deliberately transgresses the divide between digital and the physical, that consciously alters modes of representation, can introduce a form of serendipity, of exploration into digital modelling. Understanding the limitations of digital media, could alter the role of a digital model from representation to a an explorative device inspiring the design process – from a model of architecture to a model for architecture.

**References**


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