Technology as a Creative Process

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Image: Jia Jian Saw – Salt Works Exploration –Year 3 Tutors: Sara Shafiei, Aleksandrina Rizova, Ricardo Assis Rosa

Introduction

Technology, defined as *knowledge gained through making*, is the process of creation and production (Watson, 1997: 121). This is the common definition of *tacit knowledge*, which is knowledge learned through tactile and empirical experience. This definition clearly emphasises the importance of a long-standing alliance of technology with architectural design and its execution. After years of practice, professionals see no distinction between the two fields. "Students should perceive technology as a thoroughly integrated activity, not one which can be separated into content and process or theory and practice" (Williams, 2000). Nonetheless, they are still taught as two disciplines in the educational curriculum. The aim of this paper is not to discuss the reasons behind the separation between technology and design but investigate how best to integrate them.

Design and the learning environment

I should clarify that in the context of this paper when referring to design, I refer to *architectural design* as the term *design* is widely used and can be understood differently by other professionals. Design is a noun, a verb and for some it has become a fashionable adjective. In a more specific context, the design is an *end product* or design is a *process*. "Essentially the designer's thinking is directed towards some physical end product the nature of which must be communicated to others who may help to design it and to construct it" (Lawson, 2005:129).

In the context of pedagogy, one of the theories most applicable to architectural education is 'Problem Based Learning' where "students learn about a subject through the experience of problem solving. Students learn both thinking strategies and domain knowledge" (Wiki, 2013). The architectural studio is a conceptual ground for students to develop the required skills of controlling multi layering information, manipulate physical and digital media to explore and represent, as well as being supported by peer tutors, critiques and practicing professionals. The studio is conducive to self-expression, individuality and competition that results in innovative ideas and creative proposals. If a studio culture is well facilitated, it is quite likely that the outcome is at the cutting edge of architectural ideas. Students "learn how to design largely by doing it, rather than by studying it or analysing it" (Lawson, 2005:7). This strategy provides the students with the best environment to test ideas, develop skills and to engage with the process of design. The relationship with the tutors provides them with support and strategic guidance permitting growth, innovation and knowledge development through doing, making and testing. There are different schools of thought in relation to the style of education and promotion for creativity and innovation in architecture. "One school of thought may suggest that students should be allowed a free and open-ended regime in which free expression is encouraged. Another might argue that designers have to solve real-world problems and they should pay attention to the acquisition of knowledge and experience" (Lawson, 2005:155).

The *way designers think* has been studied and discussed by several theorists (Lawson, 1980; Schon, 1982; Rowe, 1987; Buchanan, 1992; Nigel, 2011) but it is not the intention of this paper to discuss these findings. I would like to draw upon Bryan Lawson's research presented in his book: "How Designers Think" (2005). He discusses different types of thinking and describes *reasoning* and *imaging* as probably the most important to designers. "*Reasoning* is considered purposive and directed towards a particular conclusion [logic, problem solving and concept formation] whilst *imaging*, on the other hand, the individual is said to draw from his or her own experience, combining material in a relatively unstructured and perhaps aimless way" (Lawson, 2005:137). "The control and combination of rational and imaginative thought is one of the designer's most important skills" (Lawson, 2005:138). In teaching design it is relevant to acknowledge these two ways of thinking as students have to learn to interplay with their rationality and creativity. There is no specific methodology to design yet students need to acquire knowledge and experience. A study by Laxon (1969) on design education in schools concluded, "children cannot expect to be truly creative without a reservoir of experience". Laxon further developed a learning model using the metaphor of a hydroelectric plant that I have adapted and adjusted to create the *Kitchen* metaphor. Just like Laxon's model there are three stages in which major skills are identified and developed. "The ability to initiate of express ideas is dependent on having a reservoir [fridge] of knowledge from which to draw these ideas. The second skill is the ability to evaluate and disseminate ideas [work surface] and finally, the transformation or interpretive skill [dining table] needed to translate ideas into appropriate and relevant context" (Laxon, 1969).

Image: Andrea Roe – Fibreglass
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Architecture and Technology

"Over the past decade, the practice of architecture has radically transformed through the digital acceleration and sharpening of production. New architectural languages are being constructed through the conversations between material, tool and design intent" (Glynn, 2011).

Whatever idea or concept an architectural designer might propose; materiality and fabrication processes are definitely key components to the architectural proposal. Materials define what an architect designs and the process in which this is executed is not

always in the hand of the designer. Industrialization and modern times have lead us to an efficient and more sophisticated architecture that has also resulted in a mass simplification. Today's catalogues, material libraries and online databases provide endless solutions to material properties and their applications; these foster the "already prevalent preference of form and surface over structure and materiality" (Leatherbarrow, 2009:9). The creation of architecture can become a mere practice of applying textures to buildings that are replicated from virtual prototypes that become 3D catalogue displays of manufacturers' products.
Similar historic discussions have shaped our contemporary context. John Ruskin (1819–1900) and Gottfried Semper (1803–1879) advocated for the truth to materials, honesty to construction and the emphasis on meaning and function in materials. This raises questions about the role of the architectural designers and their positioning towards technology. Through our industrialised and efficient world the architect is losing his proximity to the workshop and becoming an information manager behind the computer. However, Renzo Piano stated, "An architect must be a craftsman, someone who does not separate the work of the mind from the work of the hand". Frank Barkow (2013), as keynote speaker in the "Prototyping Architecture" conference a few weeks ago, spoke that "design follows technology - Identifying and harnessing new technologies coupled with curiosity and imagination reinvigorates a process of making and invention"(Stacey, 2013:367). In a new era of digital craftsmanship, which has already begun, the role of the architect will be re-defined.

What are the consequences of this rapidly changing relationship between technology and design in the context of education? If we are educating the architects of the future, then we need to provide architectural students with the appropriate approach to design and technology, and prepare them with the right skills.

One of the fundamentally important skills for being a good designer relies on one's ability to provide different solutions to problems and to be able to explore the feasibility of these options. This ability of designers to run different lines of both conceptual and practical thought and to work at varying scales of exploration simultaneously is what distinguishes a designer. Boyer and Mitgang quote Pier Luigi Nervi, who said, "a good architect is someone capable of seeing the main problems of a design, capable of examining with serenity the various possible solutions, and who finally has a thorough grasp of the technical means to accomplish the projects" (Boyer and Mitgang 1996: 137).

Lawson (2005:219) concludes in his research that "good designers are able to sustain several 'conversations' with their drawings, each with slightly different terms of reference, without worrying that the whole does not make sense". He further explains how this ability "to live with uncertainty" is what enables a designer to hold onto an 'idea' and explore it almost ruthlessly until a feasible solution has been found. One of the key fundamental ways in which students can learn these abilities is to initially provide them with a framework to allow them to begin to play with the different layers of knowledge. Students need to develop a conceptual understanding of the operation and to be able to articulate it. To explain how the use of technology in the studio might operate, I would like to propose the metaphor of the kitchen as an example. If you want to cook a multi course meal you have to have the infrastructure to support it: stove, pots, pans, knives, working surface, clean water, etc. [computer with software, printer, paper, pencils, ruler, modeling tools, glues, etc.]. This framework will support the idea to be explored. We can use a fictional brief in this case: a Thai inspired seafood risotto. Now the designer/Chef has to get the appropriate ingredients, test flavors, mix spices, experiment with different cooking processes [sketches, precedents, 1:50 sections, 1:5 detail, digital model, physical testing, etc.]. Finally after exploring different methods and testing the process the meal is developed to perfection. The tendency in architecture, however, at times seems to be to expect students to deliver amazing meals but not to first provide them with the knowledge of how to work with varying layers of information. First an omelette then a soufflé.

For the design to be a process, the framework is the way in which one can 'have a conversation' with the work at hand. The Chef can only know the outcome of the new meal once he has gone through the process of testing and exploring beforehand. The various experiments enable the designer/Chef to research into the process and perfect the idea. Donald Schön (1983) first suggested the idea of 'having a conversation with the drawing' when he researched the mental process of thinking about design. In his view, supported by Lawson in his subsequent research, "The designer performs the act of drawing not to communicate with others but to pursue a line of thought. As the image of the drawing develops it enables the designer to 'see' new possibilities or problems" (Lawson, 2005:266). It would be important to add to Schön and Lawson that in the context of architectural design, drawings are only one of the media used to 'cook' a project. The successful schemes coming out of the leading schools of architecture are composed of multi layers of hand and digital drawings, digital and physical models, videos, installations and portfolios. In this context, the conversations between the architectural designer and his works are multi-dimensional and multi-layered because the designer relies on making and testing to develop the scheme.

This multimedia approach was already at the centre of the Bauhaus (1919-1933) methodology, which was founded on the idea of integration of the arts, crafts and architecture, much in line with some of today's schools of architecture. Although the type of architecture (final product) proposed is quite different, the teaching system was based on stimulating individual creativity through making collages and different materials and textures.

In the context of architectural studio Boyer and Mitgang (1996:73) observed that "the term design has taken on limited connotations, focusing more on aesthetics and theoretical dimensions of design than on the integrative nature of the process itself". This dichotomy is further highlighted by conceptual explorations and visually appealing graphics that are highly valued among tutors and peers. Students view 'technology' as a separate entity to design, usually taught by different tutors and perhaps in different learning environments. Their notion of the subject is transfixed with boring line drawings, dry AutoCAD plans and technical details that they constantly struggle to execute correctly and to represent rich spatial qualities. "Students should perceive technology as a thoroughly integrated activity, not one which can be separated into content and process, or theory and practice. (Williams, 2000) The issue is not with the content of technology but with the way it is presented to the students. Technology should be taught in the same way as design is taught: as a creative exploratory process.

Proposal for an integrated methodology

I suggest three successive phases that could inspire students to integrate technological thinking: The first requires an exploration of materiality without a particular goal. The students are encouraged to *befriend* a material of their choice, to research and become knowledgeable in this materials by looking at the origins, sources, processes of manipulations, multidisciplinary applications, precedents and importantly, to manipulate and test the material themselves. The intended outcome is for the designer to start to build up a deeper experiential knowledge of materials. By manipulating and designing small fragments, they get an intrinsic knowledge of the potentials and limitations. In the future, when a design problem arises, the designer will access this reservoir of knowledge.

The second phase should concern with exploration and enquiry. Once the design problem is more advanced, a process of enquiry begins to filter through the project. What possible solution can I offer to this problem? How can this be constructed? What is this made of? Which project is similar?, etc. This level of investigation provides a rich fertilization to the project. It allows the designer to become flexible and to find the best solution to the problem. It is better for there not to be a design of a buildings as such but an array of possible opportunities and proposals. A tendency of students is to hold onto their schemes as long as possible ignoring the design process as a journey of exploration and investigation. The interesting parts of this phase are the research questions which arise. The questions are many times richer that the answers, they provide the spine of research which enables the project to excel. This is "learning through empirical experience and design as reflection and research on action" (Watson, 1997:125).

And finally the third phase is when technology and design are expressed through their relevant importance in the project. Up until this phase, components were fragmented, held together by the working framework, through the idea and the designer's mind. It is important that emphasis is given equally to the creative and scientific insights. "An intimate relationship between technical knowledge and design conception" (Watson, 1984:37) is required. It is fundamental that designers get real experience about buildings. Students need to have contact with the real material and its process by making real projects, building prototypes, going to relevant site visits, factory visits and being in contact with the real process of making architecture. This is essential to substantiate the designer's knowledge. For technology and design to become part of the same *conversation,* the designer must have experience of *the real* in order to express this in concept. The process of drawings and computer modelling do not contain sufficient experiential knowledge about technology, they are conceptual representations suitable for when the designer already has the *real* experience.

If technology is introduced as an addition to the design process, as a parallel analysis of the design project, then the result is likely to be less integrated. If it evolves as an exploration through material investigation at the early stage of the design concept, followed later by a creative exploratory enquiry into construction, structures and environment, reiterating different possibilities followed by being in contact with real projects and examples the final outcome is naturally more integrated.

Conclusion

In order for technology and design to develop naturally within student's projects, it is important to set up a learning environment that encourages technological investigation to be as creative and as conceptual as the design process. A balanced relationship between studio working, one to one tutorials, group seminars, taught classes and inspirational lectures should provide the student with a healthy studio culture, to become independent and work creatively.

The proposal presented in this paper is for technology to be presented less as a factual and formal knowledge through lectures but more as an exploration in making through investigation and

experience. This should be brought into the projects right from the start encouraging a physical interaction and experiential knowledge of materiality and applications.
Throughout the design process and at carefully managed phases, students are asked to explore potentials of construction, structures and environmental design, creating possible iterations, solutions and potentials without the need to have a final scheme in mind. This argument is supported by Watson (1997:125) who concludes in his paper "The design process is incomplete if technology is not made part of the creative process". Technological knowledge is an important factor in the design enquiry and not a parallel process or even worse – an afterthought to the creative process.
When drawing upon Donald Schön's (1983) "reflection in action" theory on how designers think, we are able to identify a necessary process of "problem setting" where the designer is required not only to solve problems but to be able to create a process of technical enquiry in the work itself. By creatively empowering technology to interplay with the design concept at an early stage, the process of design resolution is faster and more efficient, proposing not only innovative spatial opportunities but also technological advances.

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Bibliography

Boyer L. and Mitgang L. (1996) *Building community:* A New Future for Architecture Education and Practice, Princeton New Jersey

Glynn, R. Sheil, B (2011) *Fabricate*, Riverside Architectural Press.

Lawson, B. (2005) *How Designers Think.* Forth Edition. Architectural Press

Leatherbarrow, D. (2005) *Surface Archiecture*, MIT Press

Laxon, M. (1969) *Design Education in Practice*. Attitudes in Design Education. London, Lund Humphries

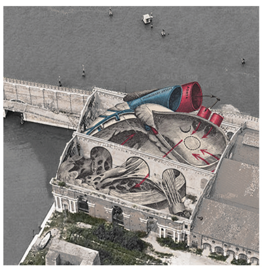
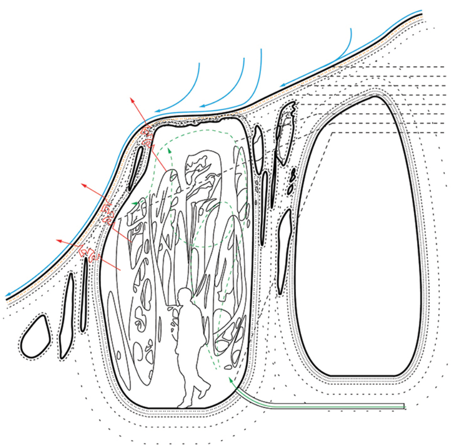
Schon, D. A. (1983). *The reflective practitioner: How professionals think in action.* New York: Basic Books

Stacey, M. (2013) *Prototyping Architecture.* [online] The build Centre Trust, London

Williams, P. (2000) Design: The Only Methodology of Technology? In *Journal of Technology Education.* Vol. 11 No 2

Watson, D. (1997) Architecture, Technology, and Environment. In *Journal of Architectural Education.* Vol. 51, No 2 pp. 119-126

Wiki 2013 http://en.wikipedia.org/wiki/Problem-based_learning

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