ACADEMIC DESIGN

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Abstract

This paper proposes to reshape the discussion design schools about the relationship of design practice to research. Many universities now have very successful design departments that educate high-level design practitioners. But the rapid growth of these departments, popular as they are with students, has meant that there has been very little time to step back and reflect on the nature and development of academic design in its new environment. Consequently, the formation of an academic design practice that can take its rightful place among other academic fields has been slow. In this paper we will propose a model of academic design and critically assess its qualities, as well as the challenges that lie ahead for this new species of academic design practitioner. The model builds on recent work dealing with forms of abduction in design, and on a few papers that describe the development of research programs at Aalto University.

Keywords: Abduction, Design theory, Industrial design, Design practice

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Please cite this paper as:
Surnames, Initials: *Title of paper*. In: Proceedings of the 20th International Conference on Engineering Design (ICED15), Vol. nn: Title of Volume, Milan, Italy, 27.-30.07.2015

1 INTRODUCTION

This paper proposes to reshape the discussion design schools about the relationship of design practice to research. As we see it, this discussion is misguided unless both parties have tools for discussing the relationship in terms concrete enough to be understandable to the other party.

The background is familiar. All around the world design disciplines are moving from art schools into universities and polytechnics. Many universities now have very successful design departments that educate high-level design practitioners. But the rapid growth of these departments, popular as they are with students, has meant that there has been very little time to step back and reflect on the nature and development of academic design in its new environment. Consequently, the formation of an academic design practice that can take its rightful place among other academic fields has been slow. From the perspective of the other academic disciplines, design still tends to been seen as 'different' (and this is not always meant in a positive sense). There are many misunderstandings on the nature of design, and there often is only a very fuzzy picture of what design can bring to its new academic context. As a result, design practices are well integrated into academia in few places only, including the University of Technology Sydney, and Aalto University's industrial design program in Helsinki.

In this paper we will propose a model of academic design and critically assess its qualities, as well as the challenges that lie ahead for this new species of academic design practitioner. The model builds on recent work dealing with forms of abduction in design (Dorst 2013), and on a few papers that describe the development of research programs at Aalto University (esp. Mattelmaki et al. 2014; Keinonen and Koskinen 2007).

2 THE BABY IN THE BATHWATER: (ACADEMIC) DESIGN ABDUCTION

In order to understand some of the possible connections between design and academia, we first need to understand the way in which design differs from other academic disciplines. To penetrate to the core of design thinking, we can look at the way reasoning is described in formal logic through Roozenburg [1995], who brought the work of the pragmatist philosopher C.S. Peirce into design research. We will use a simple equation to describe the structure of a problem solving challenge. This equation distinguishes: (1) the 'what', or the elements in a problem situation, (2) the 'pattern of relationships' in the situation and (3) the 'outcome' of a reasoning process. We can compare different 'settings' of the knowns and unknowns in the basic equation to analyse the various reasoning patterns that are used in academia, problem solving and design. This comparison leads us to distinguish four types of reasoning (Figure 1).

At the start of a process of *deduction*, we know the 'elements' in the situation and we know 'how' they will interact together. This allows us to reason towards an outcome. For instance, if we know that there are planets in the sky, and we know the natural laws that govern their movement within the solar system, we can predict where a planet will be at a certain point in time. Our prediction can be verified by observations, confirming that we have considered all the players in the situation correctly and have a sound grasp of the pattern of relationships through which the sun and the planets in the solar system interact.

In *induction* in contrast, we again know the 'elements' of the situation, and we know the outcome of the interaction of the elements. If we take the planets again as an example, we can observe the movement of the planets across the night sky. Suppose we do not yet know the laws of gravity, however. Can we use our observations of the movement of these planets to formulate such laws? Logically speaking, we cannot do such a deduction. We can most certainly observe the movement of the planets, but the formulation of laws that explain their behavior is fundamentally a creative act. In the progress of science, induction is crucial: astronomers propose different working mechanisms ('hypotheses') that could wholly or partially explain their observations. They can then test these hypotheses to predict future outcomes, and check whether these are accurate by matching them with observations. The progress of science comes from discussions between scientists, who challenge and

falsify each other's hypotheses until there is agreement that a certain proposed pattern of relationships is probably 'true,' as it matches the best of current observations.

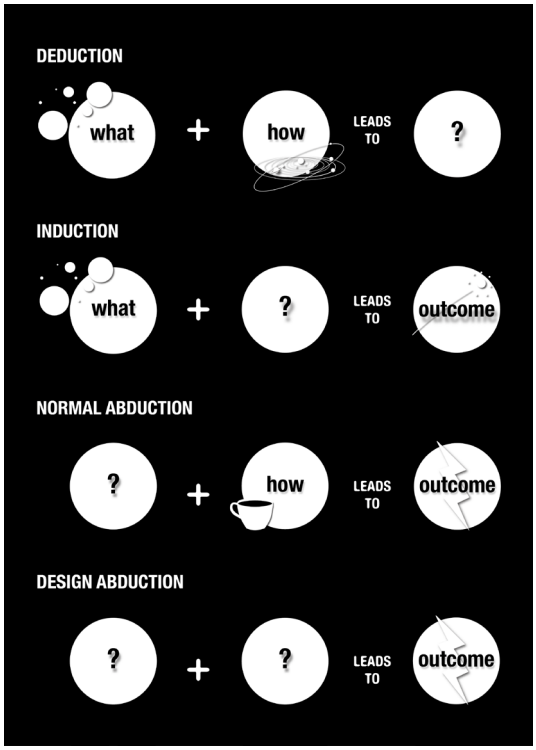

Figure 1. Four basic types of problem solving challenges that lead to different patterns of reasoning: Deduction, Induction, Normal Abduction and Design Abduction

Deduction and induction are the two forms of reasoning that serve scientists who want to understand and predict real world phenomena. But deduction and induction are not enough in the world of productive practice. That is, if we want to *make* something that is new and creates value for people, we need a different reasoning pattern, which is abduction. In abduction we set out to create a new 'what' and a new 'element' for the problem situation so that the interactions in the system lead to a desired outcome.

Abduction comes in two forms. In *normal abduction,* we know the value we want to achieve, and also the 'how', a pattern of relationships that will help achieve the value we seek. The missing element is a 'what' - an object, a service, a system – that still needs to be created. This is what engineers and designers do: they solve a problem by creating solutions that will function within a fixed pattern of relationships. So, for example, if we are looking to get a rush of energy in the morning, and a cup of coffee is the preferred way of achieving that, we can create a product or service that will make this happen.

In *design abduction*, on the other hand, the starting point is that we *only* know something about the nature of the outcome, that is, the desired value we want to achieve. The challenge is to figure out 'what' new elements to create while there is no known or chosen 'how', no 'pattern of relationships' that we can trust to lead to the desired outcome. Hence, we have to create or choose both a 'how' and a 'pattern of relationships'. As these are dependent on one another, they should be developed in parallel. This double creative step requires designers to devise proposals for both the 'what' and 'how' and to test them in conjunction. Thus, if we want to achieve a rush of energy in the morning, it could be achieved through an inspiring conversation, through meditation, or through exercise. Each of these 'hows' requires the creation of different services or products to achieve the desired outcome. Within this process there is an interaction between the proposed 'how' and 'what'. For instance, if the 'what'

is too expensive, cumbersome or otherwise unachievable, we might need to consider changing the 'how' to achieve our goal through a different framing.

The comparison between the four different reasoning patterns establishes the design professions as thinking fundamentally differently from scientific fields that are predominantly based on analysis (deduction, induction) and also from problem solving in engineering (normal abduction). As these three reasoning patterns are often most closely associated with academic research, one could argue that therefore design, with its peculiar type of abduction, should have no place in the university. But, as we will argue, this is not the right position to take. Instead, design has something new and important to offer - *there is a baby in the bathwater.*

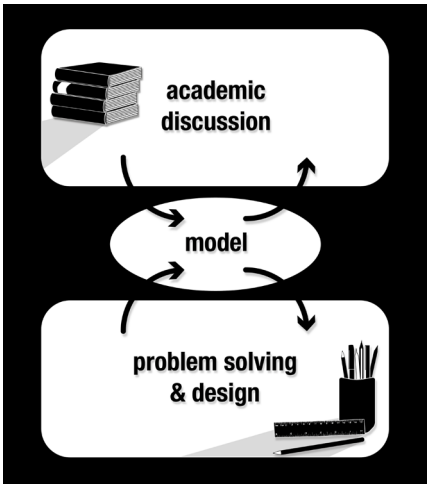

Figure 2. Integrating practical and academic considerations in a hybrid model

As an initial hypothesis about how academic design abduction works, we can map design in its practical and academic environments (Figure 2). Academic design has connection to two types of knowledge, practical and theoretical. On one hand, theoretical disciplines debate the relative merits of concepts, methods and theories with only a marginal connection to practical problems. On the other hand, design practice works with real-world professional problems and usually refers back to design precedents and practices. Our hypothesis is that academic design fits in between these two environments, and typically proceeds by developing models – usually conceptual, but sometimes physical prototypes as well – that integrate elements from practice and academic discussion alike. Usually, these models are called "frameworks" (see Forlizzi et al. 2009; Koskinen et al. 2011), although recently some researchers have started to prefer "model," which is better familiar to scientists.

3 THREE EXAMPLES OF DESIGN ABDUCTION

In our view, design abduction is the foundation of an academic design practice. In saying so, we make a clear distinction between academic design and normal design practice. While practitioners are happy in working with references to practice, academic designers also consult academic discussions about methodology, theory, and concepts in their work. They look for problems and insights from these academic discussions to understand, model and frame the problem situation. Both the what and the how components of academic design lean back on practice, but also - and equally importantly - on academic discussions. We will now clarify what such an integrated practice may look like by giving three examples. These examples will focus on the two arrows on the left in the figure: how does one bring together knowledge and practices from academia and design into an integrated whole? This can be done in various ways. The examples below also serve to illustrate the richness and the exciting diversity of academic design.

3.1 Amar G. Bose: integrating design and research

A classic example of the power of an integrated design and research practice can be found in the life and work of MIT engineer Amar G. Bose (1929 – 2013). Bose embodied the integration of research and design/problem solving practices at a very sophisticated level. As a young electrical engineering student at MIT, he was so disappointed in the quality of the high-end sound system he bought that he set out on a research path in acoustics. That led him to the realization that 80% of the sound we hear in a concert hall is actually indirect, reflected off the walls and ceiling. His research into acoustics, which sought to model this principle, sparked the development of sound systems to replicate this effect. He founded the highly successful company that bears his name. He maintained his research (and teaching) at MIT while running his company.

3.2 Materialising Memories: integrating experimental research and academic design

Another example of such an integrated academic design and experimental research practice comes from the collaboration between University of Technology, Sydney and the TU Eindhoven. These two universities collaborate in the 'Materialising Memories' project that is initiated and directed by Dr Elise van den Hoven. This research program was sparked by the realization that with increasingly ubiquitous media creation devices, such as camera phones, creation of personal media is no longer the problem, but curation and retrieval are. Most media are created for mnemonic reasons and used as memory cues - but with media retrieval failing, human memory is not well supported.

The Materialising Memories research program investigates the effects of physical and digital media, their creation and curation on memories in everyday life. That knowledge will be used to design, implement and evaluate interactive systems that facilitate remembering and forgetting. Please note that in this example, the initial project inspiration has come from developments in science and technology rather than from a perceived problem or opportunity in practice. Academic design takes the role of operationalizing research from science and technology – in ways that will surely be interesting for companies like Océ/Canon and others: the human theme at the basis of their 'printing and copying' business models is actually the support of memory and forgetting.

3.3 Empathic design: from induction to design abduction

Our third example comes from the world of contemporary industrial design. A group of researchers in Helsinki have used the term empathic design to describe their activities from the end of the nineties. Their work was initially a way to work with emerging problems in information technology. Information technology posed industrial designer with challenges that could not be responded to by traditional methods of design. Instead of working with materials and industrial manufacturing techniques, designers had to find ways to understand software and interaction as materials and develop processes for achieving a detailed understanding of users rather than making assumptions about them.

When searching for new ways of designing, empathic designers turned to several sources for help. They learned ethnographic methods from contextual inquiry and also from several sociologists who had been working at Palo Alto Research Center. With ethnographic methods, they were able to turn the 'what to design' question into a set of procedures. When coming to the how question, they turned to design practice, which gave them tools for conceptual design, yet they were also influenced by analytic induction in sociology. The fact remains, though, that both the what and the how parts of the basic design equation we have outlined above, were not turned into unambiguous procedures (or rules ('laws') that designers should obey). The work, for this reason fits our description of design abduction, in all its open-endedness.

This was even more obvious in the second phase of empathic design, which built on cultural probes, which had their roots in the avant-garde art movement known as Situationism, but also in psychoanalysis and critical theory in philosophy and sociology (Gaver et al. 1999). Among empathic designers, those who followed these more artistic traces were doubtful about the powers of both systematic methods of ethnography (how does one collate and interpret this type of data, and make it

useful in the context of a design practice?) and about the usefulness in building analytic process around the notion of induction. The preference, instead, was to work through data gathering, interpretation and analysis as an iterative process in which observations informed questions that informed further observations and so forth. Again, both the 'what' was treated as unknown, as was the 'how.' The only solid thing in the process was the determination to reach a physical or conceptual outcome, the end result.

Empathic design, however, referred a lot to theory. Its basic approach to emotions, for instance, ran counter to the prevailing theories of emotional design of the latter part of the nineties. Instead of looking for inspiration from Rosalind Picard or Patrick Jordan, empathic design turned to symbolic interactionism that taught them to see emotions as interpretations of bodily processes (see Battarbee 2004). Theories to empathic design came from the social sciences and to some extent psychology. The methods, on the other hand, came from design practice. Even when they had roots in sociology departments, as in the case of ethnomethodology, the references were usually filtered through practical sources like contextual inquiry (Kurvinen 2007; Beyer and Holtblatt 1998). As a whole, empathic design simultaneously negotiated its way through the academia and practice. At the PhD level and beyond, the outcome of the theses have been frameworks that have been later utilized by other researchers and also industry. Examples of these frameworks are "co-experience" (Battarbee 2004) and "prototyping social" (Kurvinen 2007).

4 CONCLUDING REMARKS: TOWARDS A DISCUSSION ON ACADEMIC DESIGN

As we noted in the beginning of the paper, design has increasingly been moving from small independent art schools into polytechnics and universities. This paper has explored some of the changes design undergoes in this change, the outcome of which we have called "academic design." As our examples show, academic design has a few distinguishing features.

(1) The model that sits *between* the field of design practice/ problem solving and the field of academic discussion has a dual nature: it can be seen as the 'framing of the real world problem' when we look from the side of design, while from the side of academia, it can be seen as an experimental model that has been derived from academic thoughts and discussions, translated into potential (experimental) action. Thus this is where theory and practice interact[1]. What makes this central modeling activity in the space between design and academic discourse doubly important is the fact that through this modeling of reality, we are abstracting from everyday problem solving – and this creates a new vantage point, creating an overview that allows us to look further forward (see Figure 3).

[1] Please note that in classical academic discourse, theoretical knowledge is seen as higher than practical knowledge – the latter is seen as 'applied theory' rather than a source of knowledge in itself [Lakoff, 1999]. Conner [2005] however shows how great academic breakthroughs are often rooted in the need to better understand something for practical purposes. Practice embeds and embodies theoretical thoughts, and throws up the questions that drive many academic discussions.

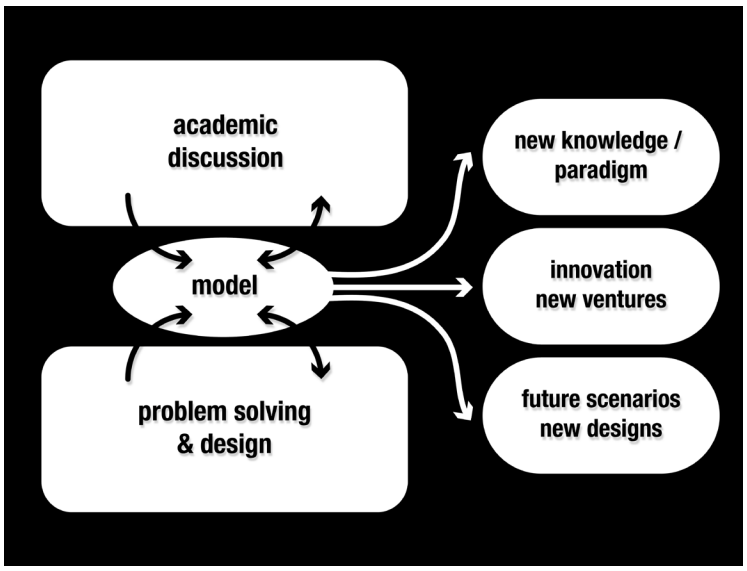

Figure 3. The abstraction of the model creates the possibility to extend our thinking into the future

As we have seen in the Bose example, this modeling allows the practitioner to create scenarios that express new possible futures for the field. It transcends real-world design practice by not just dealing with extant situations and discussions, proposing scenarios that project further into the future than professional practice can normally see. The integration of design and experimental research can thus lead to new knowledge, new ventures and radically new designs.

(2) Academic design is very much a construction rather than something that has evolved naturally from design practice. It has grown in design schools that have become integrated into universities and polytechnics, in which it has by and large been a response to a perceived need to improve research. The fundamentally ambiguous, integrative, dual nature of academic design that is its key strength (see figure 2) is also its Achilles Heel: this position between practice and academia means that it can be criticised from both of its 'parents', and will often be required to answer to their two very different sets of quality criteria. This criticism can be quite vicious, especially from practitioners in professional design fields - it can even border on the aggressive when academic design is perceived as a threat. And to an extent, this is understandable: the advent of academic design can give the unfortunate and wrongful impression that the design world is being pushed into a direction where a lot of designers personally really do not want to go. This is an important point of critique, and it should be addressed urgently.

(3) Academic design at its core is about combining academic discussions and design practices. This dual nature means that at its core lies discourse, discussion and debate; it is neither research or theory purely for its own sake, although for stretches of the academic design process, when a deeper understanding is needed, this type of thinking can be quite dominant (as we have seen in the Materialising Memories example). Nor is it applied research, as in the mere application of academic knowledge to design problems. Rather, it is a response to the challenges faced by the design professions, to deal with problems of ever greater complexity (requiring more sophisticated ways of gathering, interpreting and curating knowledge) and to develop the capacity to look further into the future than conventional design practice often allows. The latter point is actually very important: leading companies are gravitating towards academic design as they are seeking to become 'design-led' in their development of new technologies - effectively moving from the classic 'R&D' model, where design follows developments in science and technology, to a 'D&R' model in which design is required to lead investment in research and technological development.

(4) In this new environment academic design is not just based on dynamic discourse, it is also fundamentally nomadic (or, homeless, if you want). As academic designers have a foot in practice as

well as in universities, they can move in and out of the academia. A good deal of the best academic design takes place in companies like IDEO, Johnson & Johnson, Microsoft, XEROX PARC, or Nokia. For this reason, best practice is sometimes in practice, sometimes in universities. With more and more design researchers working in companies, design research has found multiple home bases.

It is clear that the advent of this new 'species' of design does come with its challenges. In this paper we hope to have some qualified of the discussion around academic design (and the perception of threat that some practitioners might feel) by making clear that 'academic design' is a new and different design practice, which arose in the context of design schools and is quite distinct from 'normal' design practice.

While many design fields feel the pressure of increasing complexity and the need to integrate some kind of applied research into their ways of working, there is no reason for all designers to join this new species of academic designer, nor should all design students be educated to become 'academic designers'. The advent of the 'academic designer' signals a welcome new branch to the family tree of design. Yet any questions remain: how could/should or will this species evolve? How will the other species in the ecosystem (professional design and academic practices) adapt to the newcomer? Who will take the lead in the development of academic design? Will specific 'kinds' of academic design arise as separate practices, or should we envisage academic design as being very dynamic, going to the areas where the issues are – not joined to one particular field of design practice?

We do not know yet.

What we do know is that the future of academic design is ours to shape.

REFERENCES

Battarbee, K. (2004). Co-Experience. Helsinki: UIAH.

Beyer, H., & Holtzblatt, K. (1998). Contextual design: Defining custom-centered systems. San Francisco, CA: Morgan Kaufmann.

Conner, C.D. (2005) A people's history of science, Nation Books, NY.

Dorst, K., (2013) Academic Design, published inaugural lecture at the TU Eindhoven, Tu Eindhoven, The Netherlands.

Forlizzi, J., Stolterman, E., & Zimmerman, J. (2009). From design research to theory: Evidence of a maturing field. Proceedings of IASDR, Seoul, South Korea, 19–22 October, 2009.

Gaver, B., Dunne, T., & Pacenti, E. (1999). Cultural probes. interactions, January–February, 21–29.

Keinonen, T. and Koskinen, I. (2007). Research-Driven Design Education. International Association of Societies of Design Research, IASDR'07, Hongkong Polytechnic University, 12-15 Nov. 2007

Koskinen, I., Binder, T., Redström, J., Wensveen, S. and Zimmerman, J. (2011). Design Research through Practice: From Lab, Field, and Showroom. Morgan Kaufmann: San Francisco.

Kurvinen, E. (2007). Prototyping social action. Helsinki: UIAH.

Lakoff, G., Johnson, M., (1999) Philosophy in the flesh - the embodied mind and its challenge to Western thought, Basic Books, New York.

Mattelmaki, T., Vaajakallio, K., Koskinen, I. (2014). What Happened to Empathic Design. Design Issues, 30(1), 2014

Roozenburg, N.F.M., Eekels, J., (1995) Product Design: Fundamentals and Methods, Wiley, Chichester.