IASDR07
INTERNATIONAL ASSOCIATION OF SOCIETIES OF DESIGN RESEARCH THE HONG KONG POLYTECHNIC UNIVERSITY 12TH TO 15TH NOVEMBER 2007

DESIGN RESEARCH, DISCIPLINES, AND NEW PRODUCTION OF KNOWLEDGE

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ABSTRACT:

The paper discusses the need to develop design research as a discipline. By using Gibbons et al's distinction between the traditional disciplinary type of Mode 1 knowledge production and the emerging type of Mode 2 knowledge production that takes place in the context of application, it shows that design has unique characteristics that should not be given up when seeking academic acceptance. Mode 1 and Mode 2 are linked to other discussions identifying a change in the relation between research and society that may benefit design research. A couple of existing disciplines (IS and HCI) as potential role models are examined and judged.

1. INTRODUCTION

One of the most persistent issues in design research has been the question of knowledge – what is the nature of the knowledge needed for design, and correspondingly, what should the nature of

design research be. One influential idea has been that to be legitimate design research should imitate traditional scientific inquiry practiced in universities. This has been opposed to on the basis of the unique nature of design knowledge.

The relationship between design research and other, better-established research done in universities has always been somewhat strained. The “real research” done within the already established disciplines has looked more “scientific” and “serious” than the work done by design researchers. The development of a more serious and systematic approach to design and design research is not a novel phenomenon: the first wave took place already in the 1960s with the design methods movement. Initially there was a quest towards a “science of design”, a prominent advocate of which was Herbert A. Simon: “The professional schools will reassume their professional responsibilities just to the degree that they can discover a science of design, a body of intellectually tough, analytic, partly formalisable, partly empirical, teachable doctrine about the design process.” (Simon 1969, p. 58). The initial prospect towards this new science was, however, found to be too ambitious, and the program of putting design onto firmer intellectual grounding is currently content with more modest formulations, such as making design a discipline: “Design is now becoming a discipline that may readily be applied to processes, interfaces between media or information artifacts as to tools, clothing furniture, or advertisements. To understand design as a discipline (…) means developing a general theory of design.” (Friedman 2003, p. 509). Susan Poggenpohl summarizes the current situation well in the introduction of a forthcoming book: “While it fundamentally calls for the transformation of design from its craft origins to an evolution into a discipline (…) … it also depends on design faculty that understands academic structure from a broader perspective and use institutional supports like research offices, peer-reviewed journals, interdisciplinary opportunities, and conferences to their advantage. This is in contrast to special pleading that design is unique and requires reinterpreted structures or special terms of assessment in academia. If design is to develop as a discipline and take its place among other disciplines, it must necessarily develop the three themes this book develops: research, method, collaboration.” (Poggenpohl forthcoming, unpaged). I fully agree with Poggenpohl’s vision on design as an academic discipline, but I would like to continue to discuss how far existing disciplines in academia can and should be mimicked in the development of the design discipline. In this paper I would like to point to an interesting development within academia itself, which seems to be pointing to opposite direction – existing disciplines covertly if not overtly imitating the design way of producing knowledge. This can be conveniently studied by referring to the discussion around one particular book.

2. THE NEW PRODUCTION OF KNOWLEDGE

About 10 years ago Michael Gibbons together with his colleagues published a book “The new production of knowledge” (Gibbons et al. 1994). The main message of the book is that besides the traditional disciplinary production of knowledge (“Mode 1”) a new, quite different form of knowledge production (“Mode 2”) was emerging within university research. The authors claimed that although Mode 2 knowledge in many ways deviated from the values and norms traditionally used to assess the quality of research, it was no less legitimate than traditional Mode 1 knowledge.

The Gibbons et al. book did gain a lot of popularity (it has been reprinted 9 times since publication) and it rapidly became the centerpiece of a heated debate (according to Google Scholar it has been referenced more than 2000 times). The book was accused of being as an attempt to legitimate sloppy, consultancy-like research, while the defenders praised the attempt to bring the ivory-tower science closer to the demands of real life outside the walls of universities. The authors continued the discussion in another book (Nowotny et al. 2001), which also has been reprinted already five times, showing that the interest in the topic is still high.

Gibbons and his co-authors describe the Mode 1 type of knowledge production as follows: “In this issue the term Mode 1 refers to a form of knowledge production – a complex of ideas, methods, values , norms – that has grown up to control the diffusion of the Newtonian model to more and more fields of enquiry and ensure its compliance to what is considered sound scientific practice. Mode 1 is meant to summarize in a single phrase the cognitive and social norms, which must be followed in the production, legitimating and diffusion of knowledge of this kind. For many, Mode 1 is identical with what is meant by science. Its cognitive and social norms determine what shall count as significant problems, which shall be allowed to practice science and what constitutes good science. Forms of practice which adhere to these rules are by definition scientific while those that violate them are not.” (Gibbons et al. 1994, p. 2-3). They continue to observe that Mode 1 problems are both raised and solved within academic research community contexts, Mode 1 knowledge is sharply disciplinary and homogenous and it is “owned” by a particular sub community. Mode 1 knowledge is also hierarchical and preserves its form, and the quality control for Mode 1 knowledge takes place solely through the peer review judgments made by individual researchers belonging to a particular single research community.

In contrast to this the features of Mode 2 knowledge production are as follows: knowledge is produced not in a detached laboratory but in a context of application; produced knowledge does not belong to a single discipline, nor is it distributed mainly through disciplinary distribution channels, but it is instead transdisciplinary and distributed to different stakeholders in the process of production itself; Mode 2 knowledge production is heterogeneous in terms of the skills and experience people bring to it; the value of the knowledge is not only judged by intra-disciplinary peer review, but it must also be socially accountable in the context of application and in the eyes of a broader group of stakeholders.

While Mode 1 research in its purest form ("basic research") is steered only by human curiosity and any practical considerations are absent, Mode 2 research is always closely linked with the potential usefulness of the results to somebody, either to a real stakeholder or to society at large. Moreover, Mode 2 knowledge would not be produced at all if the interests of various actors were not taken into consideration. Gibbons et al. state that Mode 2 knowledge is produced in the context of application. Mode 2 knowledge production, however, not usually what is termed applied research – the application of results from basic research to practical problems – because there are neither such basic research nor results available.

While a significant Mode 1 characteristic is disciplinary distinction of knowledge, in Mode 2 the solution needed for the final problem is typically beyond the boundaries of any single discipline. According to Gibbons et al. the knowledge needed is, however, not achievable by just bringing pieces of knowledge produced by different disciplines together, but by integrating them in the specific context of application. They call this sort of integrated knowledge transdisciplinary.

Mode 1 knowledge is produced by academically qualified professionals in universities, but Mode 2 production is more heterogeneous and organizationally varied. In the context of application not only academic researchers but all participating stakeholders can and often will participate in the production of new knowledge. The production can also take place in other venues and organizations than universities, and even in temporary and transient formations.

The main accountability of Mode 1 researchers is towards their own disciplinary scientific community, but with Mode 2 a broader social accountability permeates the whole process from the start. Mode 2 research is launched for a purpose outside the scientific community, and it is done in the context of a particular application for certain stakeholders, and these all have to be taken in the account. Researchers in university departments engage in Mode 2 knowledge

production because of its relevance to some goals – a relevance that Mode 1 knowledge production is often lacking.

Finally, the traditional form of quality control of the knowledge produced in research is traditionally done in Mode 1 through peer review by other researchers belonging to the same scientific community. Reviewers are carefully selected internally in the community from members who have shown competence in earlier research, typically senior members of the community. In Mode 2 the context of application brings in a number of varied intellectual and other interests, such as social, political or economic ones, and it depends on the situation which of these interests will be considered legitimate. Thus both the criteria for quality control and the range of potential evaluators are much larger than those in Mode 1.

When we look at these definitions, it is somewhat surprising to find that design is clearly an exemplary form of Mode 2 knowledge production – it fulfills each of the criteria discussed above. We can also see that at least some proponents of a "design research discipline" are not satisfied with being Mode 2; they would like to see design research moving more into the Mode 1 type of knowledge production to gain the academic respectability of well-defined disciplines. Thus the situation is quite interesting: if we agree with Gibbons et al's observations, knowledge production in universities is – because of needs of society – at least partially moving towards what already is standard practice in design, while design research is at least to some extent trying to move to the opposite direction – against the current, so to speak.

What could be learnt from this interesting anomaly? As suggested by a number of prominent design researchers (e.g. Buchanan 2001, Findeli 2001, Friedman 2003) some kind of change is taking place within the broad field of research and the whole society, and Gibbons et al are also reflecting on that.

3. CONTEXTUALISING THE NEW KNOWLEDGE PRODUCTION

To understand the change better, let us look at a couple of other testimonies – one by philosopher Stephen Toulmin, another by an eminent member of the design research community itself, Richard Buchanan.

TOULMIN AND REASONABLENESS

In debates related to knowledge it is reasonable to seek help from philosophy, and there is indeed an epistemological discussion going on, highly relevant to the issues discussed in the previous section. In this section we take a look at this discussion, using Stephen Toulmin's book Return to Reason (2001) as our guide.

The British-American philosopher Stephen Toulmin has been a productive author in many areas, and also active as a historian of science, but a connecting theme in all his work has been the importance of practical, worldly knowledge and reasoning as opposed to abstract, formal logic and theorizing so valued by the dominating school in 20th century philosophy of science, namely, analytical and logical rationalism. Toulmin's book Return to Reason contrasts abstract analytical philosophy and formal logic with thinking in the practical world – against formally logical rationality he sets practical reasonableness, hence the name of the book. For him the "Cartesian revolution" in scientific thinking has been a harmful 300-year diversion that should be corrected. In the book he studies the issue from the perspective of the history of philosophy and integrates several philosophical debates of the 20th century into a larger, continuing movement to correct the Cartesian diversion, and to "return to reason".

In the following I will take one central line of his thought – that there is a long tradition emphasizing practical knowledge, "knowing in the world", which is specific, local and temporal instead of general and timeless knowledge so highly valued by the dominant philosophy of science.

Toulmin starts with Aristotle, who in his Ethics of Nichomachos defines three forms of knowledge. Aristotle calls the first form "episteme", which is positively known and transferable "book knowledge" – highly valued by his teacher Plato, for example. The second form is called "techne" – the skill to do something, the practical know-how. Most interesting from the point of view of this paper is the third form of knowledge which Aristotle calls "phronesis". It is knowledge that enables a person to act wisely and "right", *pros ton kairon* – according to the situation in the world of practice. It is really interesting to note, that the first two types of knowledge are well known to the extent that the terms used for them by Aristotle have been a basis for related terms in the vocabularies of many current languages, but the third one has not had such a continuity. Thus we have for example even in Finnish vocabulary the words "epistemologia" and "teknologia", but there is nothing based on Aristotle's phronesis. It is this third form of knowledge that Toulmin believes has been neglected in scientific thinking and which now must be resurrected.

According to Toulmin all the three types of knowledge had been equally valued until the end of medieval times, but the beginning of the "Cartesian revolution" brought with it the separation of episteme from the two other types. In the book Cosmopolis (1990) Toulmin connects this change also with the turbulent times in Europe at the end of the 30-year war. The war had brought a misery and chaos, and there was no justification for it – human reason had failed. Neither was religion to be trusted as a source of ultimate judgment, when killings and robberies against people having a different faith were equally practiced and justified by proponents of both catholic and protestant doctrines. There was a search for certainty, a need to find a firm ground upon which to construct such arguments that must be true irrespective of any background differences discussants might have, truths that cannot be falsified. This ground was found in mathematics and formal logic, and in axiomatic closed systems, which became the norm for scientific knowledge against which all other knowledge was gauged.

This meant that the knowledge types of techne and phronesis were devalued, and the process has been very efficient. An illustrative example is our view on rhetorics, which had long been an esteemed discipline in universities, and highly valued as a representative of practical logic, but which as a current everyday term is deprecated almost as a synonym of cheating – something is "just rhetorics".

After hundreds of years of dominance in science the ideals of Cartesian thinking have filtered down to shape our thinking and everyday experience and judgment as well. In the course of time the superiority of Cartesian thinking and epistemic-only knowledge has, however, become more and more difficult and finally impossible to maintain. Toulmin traces in Return to Reason the emergence and strengthening of opposition in philosophy against Cartesian rationality. This opposition has never been unified, but is more like a stream of different, often "life"-oriented philosophies, each attempting from varied starting positions to develop an alternative to the rather limited Cartesian worldview. Toulmin positions Heidegger firmly among these oppositional approaches although his champion among the opposition is not Heidegger but Dewey, who in his study of the relationship between theory and practice in "Quest for Certainty" (1929/1988) has, according to Toulmin developed the best founded and most convincing criticism against Cartesian thinking. In the core of Dewey's argument lies the difference between the position of the external observer and that of the participant actor, and between the potential between the holders of these positions to acquire relevant information.

Toulmin sees that we may be currently witnessing a recovery of practical philosophy: in many areas there is development towards balancing the former overemphasis of formal rationality with practical reasonableness, and increasing recognition of the importance of the phronesis type of knowledge. He characterizes this movement as

Return to the Oral (from the written and symbolically codified)

Return to the Particular (from the abstract and general)

Return to the Local (from the universal)

Return to the Timely (from the timeless and infinite).

Toulmin demands strongly that philosophy address questions relevant to its time, and addressing questions like this needs a philosophy whose subject area covers worldly practices in all their messiness and ephemerality. Toulmin and Gibbons et al. do not reference each other, but there is an obvious connection between their suggestions: in the phronesis-oriented philosophy Toulmin is opposing the limitations of Mode 1 knowledge production, and pulling together a grounding for Mode 2.

BUCHANAN AND THE NEW BATTLE OF BOOKS

Next we turn to a commentator closer to the field of design itself, Richard Buchanan, who in his paper (Buchanan 2001) starts developing his argument by reviewing the history of design, in particular with respect to its relationship with science and the academic world. He opens the paper with a passage from Galileo Galileis "The Two New Sciences", where the character representing the author tells about the importance of the practical engineers in the Arsenal of Venice to the development and sharpening of physical thinking. After this practically oriented opening of the book, however, Galilei turns away from practice and concentrates on purely theoretical explorations. According to Buchanan, the passage shows the emergence of a rift between practical design and theoretical knowledge. Buchanan then continues by discussing Francis Bacon's "Project" -- people learning to master Nature and build artificial things to serve them better and better – and characterizes that as a clear design-oriented venture. Buchanan contrasts Bacon's design project with current conceptions about technological development and notices that although there was certain hubris in the way Bacon was praising technological progress, his Project still had a clear connection with humanistic knowledge, emphasizing

rhetorics, culture and learning. This humanistic undercurrent has been lost under the "new scientific", but the need for the connection is still actual in current design.

Buchanan continues his review by examining the disciplinary development of universities, and points to the rise of the value of science, as founded by Galilei, Newton and Descartes. He notes that the construction of artificial things did not belong to the objects of learning in universities, and human practice was in general excluded, and tolerated only in a very limited way in fine arts and literature, where it is difficult to escape the fact that the objects are produced by humans. At the beginning of the modern times the actual practical side of the arts was studied in art schools outside the university system, and design in general was not accepted in universities, except fine arts and architecture as already mentioned. But even with them the practical side was seen to belong to a lower echelon of practical artisans who possessed practical skills and intuition but who were lacking in the deep understanding founded on "first principles". Buchanan mentions here the "Battle of Books" where the new "neoteric" knowledge based on the application of both methods and concepts developed in the rising natural science and the corresponding setting of the questions to be solved were contrasted with the old "paleoteric" knowledge based on experience and non-scientific principles. In the Battle of Books design definitely belonged to the paleoteric side with its principles like harmony and such.

Jurisdiction, medicine and theology had originally been in the core area of the universities, but the in the forming new universities their status started to decline because of their lack of scientific approach. In the 19th century the practical importance of engineering became so significant that it was necessary to start university-level education in it, but usually new technical universities had to be founded for that. And usually it was made (and often still is made) clear that these technical universities are only of secondary importance, because they only apply the results of science that are actually produced elsewhere, by "pure research" in universities.

After the Second World War the situation started to change and other proactive disciplines such as decision science and computer science emerged. During the 20th century design itself has been recognized as a specific discipline of its own, and it has finally made its way to universities as well, although still only a few universities are offering a doctorate in design. Anyway, times are changing, and Buchanan sees that a new Battle of Books may be emerging.

According to him, the new Battle of Books is fueled by the fact that although the scientific thinking that has been the foundation of universities during the modern times has indeed led to great

advances in theoretical knowledge, it has on the other hand led to a severe fragmentation of knowledge, so that the theoretical advances have only very limited usefulness in understanding larger issues, and in particular making informed changes in the world. New problem fields are constantly opening that do not fit in the old divisions of knowledge. In the new situation the old Battle of Books is turned upside down: the former new has now grown old, and some parts of the former old are now the new challengers. Design in particular is developing into a major force in the new neoteric learning, because it must deal with newly emerging areas and solve their practical problems, and for that it must be able to integrate fragmented knowledge. This will also need change in universities and disciplines: “But there may be a new kind of university that will also have value. It will be a university that prizes theory but does not disdain practice and does not ignore the distinct problems of, and the need for substantive knowledge about, making or production. (…) This new kind of university – and there may be only a few of them in the future – will discover a dynamic balance among theory, practice, and production, a balance that we do not find in the vision of most universities today.” (Buchanan 2001, p. 7)

Also this change seen by Buchanan can be related to a change in the needed and accepted modes of knowledge production: the initial success of science was related to the emergence of Mode 1, but now the pendulum is swinging back, and something else is needed.

4. DISCIPLINES, RESEARCH AND UNIVERSITIES

When the emerging design research discipline is seeking its role model from among the existing university disciplines, two useful issues are to be kept in mind. Firstly, universities are far from monolithic and there is a great variety and flux among the existing established disciplines, and during history there has been many changes. Secondly, we may be witnessing one more change in the relations between universities and the rest of society, which may lead to further changes in universities as well.

The development of disciplines in universities has not always been smooth and straightforward, as was discussed by Buchanan in the previous section. Closer to our times one can see that there has been a clear historical development in the ways knowledge production has been understood in different disciplines. The 20th century has been characterized in universities by the intensifying struggle of the human and social sciences to legitimate a novel and totally different way of looking at the world called qualitative research. Initially rejected as unscientific, qualitative research

methods have gained an accepted and secure position in university practices. Although proponents of qualitative research still accept many basic theses of Mode 1 research, there are fundamental ontological and epistemological differences as well. So disciplines are far from monolithic, and qualitative researchers have shown that with persistence and a good cause one can make oneself legitimate and respected.

There are, however, design-oriented disciplines that already have become accepted in universities, and let's look at two of them more closely.

EXAMPLES OF DESIGN –ORIENTED DISCIPLINES IN UNIVERSITIES

There are already design-oriented disciplines in universities each of which has found some way to cope with the academic acceptance vs. relevance of research dilemma. I will draw from my own personal history: I did my PhD and started a publication career within a discipline called Information Systems (IS), and then I got a position in Human-Computer Interaction (HCI) and have now supervised half a dozen PhDs there, so I know both the disciplines and the research communities relatively well.

IS in the US and in the UK is located in business schools, in northern Europe also in other universities under the label of "informatics". Fundamentally it is a design discipline: the basic issue is how organizational functioning can be redesigned and improved by using information technology. As a research discipline it is quite well established: it emerged already in the 1960s and there is a number of high-quality journals like Management Information Systems Quarterly, and a series of respected conferences like International Conference on Information Systems, some of them having a history of several decades. HCI is a bit younger discipline than IS, having emerged in its current form only in the 1980s. HCI is even more directly design-oriented than IS: shaping the interaction between users and information technology. Also HCI is a well-established research discipline: there are a number of scientific journals, like ACM Transactions on Human-Computer Interaction, and a variety of respected conferences, like ACM CHI, which is just celebrating its 25th anniversary. Corresponding to these two university disciplines there are also two rather large communities of practical people working on similar topics in industry and other organizations, and thus being the closest potential external audience for the research done in universities.

IS and HCI have adopted different strategies with respect to the acceptance-relevance dilemma. IS has in general opted for academic creditability in the eyes of peers from older disciplines, and correspondingly it is leaning towards Mode 1 knowledge production. In the beginning this meant mathematical modeling and measurements, borrowed from the toolbox used by other disciplines in business schools. In the 1980s and 1990s there was a long and painful struggle where qualitative methods were brought to the research community. Despite this rather large change the Mode 1 orientation prevailed: the value and validity of research was fundamentally an issue of peer review in publishing within the existing community of researchers, most of them working in universities. Whatever the methods, the work often has a high scientific quality: it is scholarly, well founded, and reflective. There has, however, always been the problem that people working with IS in industry have not been interested in IS research and scientific publications, and they are rarely seen in IS conferences, and the quantitative-qualitative break did not cause any change in this respect. Thus we have a respected discipline which does not have a strong influence in practice, but which in general seems to be content with that. (To be fair to the community it must be said that critical reflections upon this state of affairs have been recurrent, although they have hardly led to any changes.)

The situation with HCI is drastically different, because it has largely opted for relevance of research, and creditability in the eyes of practical people in industry. Current HCI was born as a discipline in the 1980s in a situation where the emergence of PCs opened a new mass-market for PC software – if such software was easy enough to be used off the self, without extra training. Because practically all previous software had been made to order with a training period included at the end, this was quite a difficult problem (which is still far from being completely solved). So there was a strong need outside the universities to provide better methods for design, and this influenced the emerging discipline as well. More academically inclined interests had already existed in universities, but they were largely pushed into the marginal, and search for methods capable of practical solutions took the lead. The research community was not limited to universities, but a large number of people from industry were also contributing steadily, and some of the most influential findings actually emerged from industry laboratories. Because of this practical orientation design-oriented solutions, like novel interaction devices, became accepted as contributions besides more scholarly papers. A certain shift of balance between forums also took place: traditionally the scientific journals have been the core around which the community activities are organized, but in HCI, and probably because of the participation of large number of industry people, the major conferences have become more and more important, and perhaps they

are at the moment leading the field. More than half of the participants of the largest and most prestigious HCI conference, ACM CHI conference, are currently from industry. The HCI field in general is still expanding, and several new conferences and journals have been started recently. Although HCI research is largely operating according to Mode 1 rules, like the importance of peer reviewing, it has also very clear characteristics of Mode 2 knowledge production, because of the large influence of industrial goals in defining the research agendas.

CHANGING RESEARCH ENVIRONMENT

There are clear signs that the environment where research is done in universities is currently undergoing change. A good example of this is the research funding by the European Union. EU is one of the largest public funding agencies of research in the whole world, and so their policies will have an influence not only on research done within the European Union and directly funded by EU, but also in the whole world as an example of a new relationship between public bodies and researchers.

EU research funding is openly selfish: the main purpose is to improve European competitiveness, either by directly improving the capacities of European industry, or by enabling European public systems to deliver better services more efficiently, and thus indirectly improve competitiveness. Most EU research funding is distributed through 5-year research programs, the current one being the 7th in the series. A couple of times per year a call for applications is issued, targeting to some specific topics within the general program, and multinational research consortiums send in applications to compete against each other. To guide researchers towards the overall purpose of the research program, a rather radical departure from the general norms of the research community with respect to evaluation has been taken. The applications are not peer-reviewed in the normal sense, but the evaluators are drawn from a “pool of experts”. Anybody interested in participating in the evaluation can send his or her credentials. From this pool EU officials select the reviewer teams for each call, and the rules of selection are not made public. Thus the reviewers can be and are usually also in practice from university, industry, or public bodies. There is no reason to see this procedure as anything else than an attempt to get the most competent experts available into a particular reviewer team, but in any case the team will be different than one consisting of mostly experienced researchers, as usually is the case in evaluations within the scientific community. Moreover, there are no automatically shared community values and norms guiding the selection process, but the evaluation criteria are clearly defined beforehand by EU,

and although the scientific quality of an application is one of the main three criteria, it is only one: the two others are the quality of the consortium and its capability to perform the proposed project; and the expected impact of the project. During the last few framework programs, the weight of the last criteria has been continued to increase: in the application template of a “small project” application for the current 7th framework research program, 20 pages are reserved for the description of the project plan, while the suggested length of the “impact and dissemination” part is 10 pages – half of what has been reserved for the project. Thus EU is interested in that knowledge in the projects will be produced and evaluated in the context of application, and also by other stakeholders than researchers themselves.

EU research funding is only one, although a large, example of the more intimate relationships between society and research, and this development may be increasing further. As the example shows, society is no more fully content with traditional Mode 1 quality control of research, and it is ready to rewrite the rules and push knowledge production towards the Mode 2 type.

5. CONCLUSION

Design research is now defining itself as a discipline in a different situation and in a different world than older disciplines have done. It may benefit from being an emerging discipline: many of the practice- and even design-oriented disciplines that arrived in universities during the time when the pressure of natural science type of rationality was still in greater force have not succeeded in resisting this pressure. To quote Simon again: “In view of the key role of design in professional activity, it is ironic that in this century the natural sciences have almost driven the sciences of the artificial from professional school curricula. Engineering schools have become schools of physics and mathematics; medical schools have become schools of biological science; business schools have become schools of finite mathematics” (Simon 1969, p. 56). There is perhaps a real possibility for design research to escape from this and do something closer to its own character.

It must be remembered that design research is not alone: there are a number of design-oriented disciplines in universities. So there are potential role models to be observed, much closer to design than the natural sciences. From my two examples I would strongly prefer HCI as a role model over IS. To some extent, HCI as a discipline has been able to bridge between university and society, and between scientific acceptability and practical relevance. It is not the ultimate model, however: research in HCI often takes place in an incremental way, following the

development of technology instead of searching for new openings. And in HCI discussion about fundamental issues and reflection upon them is largely missing – that is why I find the discussion within design research community attractive.

Because Mode 2 knowledge production is native to design, a change in the general research climate towards Mode 2 will be beneficial to design research and help us in establishing a discipline. This discipline should adapt from existing university practices to take advantage of what is good in them, but it should not forget the strength given to it by the nativity of Mode 2 knowledge production in seeking to be made academically creditable. Eventually it is in the hands of the design research community to define its own values and norms, what is to be considered good research – not less strict than previously, but maybe different. Perhaps Buchanan's "balance between theory, practice, and production" can be found some day.

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