SHAPING THE DESIGN RESEARCH REVOLUTION

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ABSTRACT

In 2008 the author published a paper that critiqued the state of design research. It contained an anatomy of design research, analysed its assumptions and considered the anomalies that were emerging at the time, making a case for revolutionizing the field, and mapped out two directions for further development.

Over the last 5 years, that paper has sparked keen interest and it has been quoted extensively. In this paper we will pick up the thread and report on the development of a research centre that embodies some of the changes proposed in the paper, shaping a specific version the design research revolution. This paper is built up as follows: first, the arguments of the original paper will be retraced briefly. Then the question that drives the exploration of the current paper will be elaborated and the central case study will be introduced, by describing the methodological research program and the applied research centre that serves as its platform. We will end with an informal evaluation, and position the conclusions within the broader discussion on the role of academic research in today's society.

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1   INTRODUCTION

In 2008 the author published an introduction in Design Studies called 'Design research: a revolution waiting to happen' (Dorst, 2008) that critiqued the state of contemporary design research. It contained an anatomy of design research, dissecting the field down to the assumptions that commonly underlie the practices of many design researchers. Then it considered the anomalies that were emerging at the time, making a case for revolutionizing the field, and mapped out two directions for further development.

Over the last 5 years, that paper has sparked keen interest and it has been quoted extensively. In this conference paper we will pick up the thread from that 2008 paper and report on the development of a research centre that embodies some of the changes proposed in the paper, shaping a specific version the design research revolution. This paper is built up as follows: first, the arguments of the original paper will be retraced briefly. Then the question that drives the exploration of the current paper will be elaborated and the central case study will be introduced, by describing the methodological research program and the applied research centre that serves as its platform. We will end with an informal evaluation, and position the conclusions within the broader discussion on the role of academic research in today's society.

2   A CRITIQUE OF DESIGN RESEARCH

The original paper critically considered the then state of design research. This analysis resulted in three key critical points, that we need to reiterate here:

2.1   No explanatory frameworks

In a scientific discipline that is aimed at the study of a complex area of human activity like design, one would expect the field to be grounded in systematic observations of the complex activity, as a basis for detailed descriptions of these practices (a description which might be theory-based, and already involve a degree of interpretation). Then one would expect to see models that could explain the phenomena as observed and described. That explanatory framework would then be used to prescribe ways in which design practice could be improved, developing methods and tools to support the practitioner and the student (based on Roozenburg and Eekels, 1995).

However, within the field of design research, observations tend to be non-systematic (or the sample size very small), papers presenting descriptive studies are often very unclear on the aim and basis of the description and (worst of all) explanatory frameworks are mostly absent. Nonetheless there is a proliferation of prescriptive models, methods and techniques coming from design academics (Cross, 1984). This overwhelming orientation towards prescription, results in papers that (if they have an empirical basis at all) jump from description right into prescription, without pausing to think why the observed patterns occurred. This unfortunate lack of focus on the creation of explanatory frameworks is exacerbated by the fact that many design researchers develop methods without rigorously testing them, thus gravely imperiling the knowledge buildup in the field.

2.2   Only a process focus

This lack of rigor across the field makes it vulnerable to an uneven development: implicit assumptions might creep in unnoticed, and become 'established knowledge' or a common practice in the field. A key assumption in design research seems to be that the field should mainly or exclusively concern itself with the study of design *processes*. Yet if we consider that you would want to describe an area of complex creative human endeavor like design, the elements of a descriptive framework be would need to include the *object* of this activity (in this case, the design problem and the emerging design solution), the *actor* (the designer or the design team/designing organisation), the *context* in which the activity takes place (as far is impacts upon the activity) and the structure and dynamics of the complex of activities that is being studied ('the design *process*'). We are at a point where the deeper understanding of design activity can only be built when considering all aspects of the design activity, not just the design process (Dorst, 1997). This requires the building of a new and admittedly very complex kind of design research in which the process and content are connected with a model of the designer and the context in which the design activity is taking place. There also seems to be no view of what the design activity entails beyond the confines of 'the design project', while design practice encompasses many activities beyond the project level (Lawson, 1990, 2009).

2.3   Ignoring the link to design practice

The methods and tools developed in design research are not as widely used in design practice as one would expect. This leads to two observations. (1) On a fundamental level, the assumptions behind the methods tools should be critically considered, to check if they possibly make the methods and tools less than suited for design practice. And (2) the 2008 paper goes on to observe that momentous changes in design practice don't seem to influence design research. The enormous increase in the complexity of the challenges designers have to deal with, which translates itself for instance in the need to incorporate (value) research into professional design practice, and possibly towards a complete recasting of the role of the designer, do not show up on the design research radar.

These anomalies potentially touch the core of what we see as design science. What is the object of our studies (what do we consider to be 'design'?) and the very nature of the tools and methods we aim to create (do they have to be process-oriented?). In the remainder of the 2008 paper, two possible ways forward were explored as attempts to reframe design research. (1) The first concentrated on the studying design practice beyond the project-level, on the 'practice' level of design activity. An exploration of these concepts has since been published in Lawson and Dorst (2009, pp 60-67). (2) The second way forward moved beyond the design process towards the design problem as the subject of the design activity. This has since been taken up in books like (Hekkert and van Dijk, 2011). The designer has become the focus of studies on the nature and nurture of 'design expertise' [Lawson and Dorst, 2009]. The design context has hardly been picked up as a subject of systematic study in the last 5 years – our knowledge of the design context and its influences is still mainly based on what we can glean from informal publications in professional design journals.

The 2008 paper concluded with the remark that these three anomalies create a huge challenge for design research: the incredible complexity of this much broader field of study means that it will only be possible for design research to move forward if it moves away from description and becomes much more experimental ('action research'). To do this the design research community needs to find a way to create a strong, renewed engagement with design practice as a locus for these experiments.

3   THE QUESTION

As stated above, '*Design research: a revolution waiting to happen*' has been a popular paper, and it is often quoted by a wide array of authors in design research. Apparently design researchers (especially those with a background as a designer) recognize some or all of the points raised, and they find it useful to think along these lines. But in critiquing design research, the paper has not sparked the meta-discussion on design research the author hoped for (this is another weakness in design research: few in-depth academic discussions). This may be because while the critique of the existing state of the art was clear and empassioned, that paper in the end provided only very sketchy outlines of pragmatic and few actionable proposals on HOW to revolutionize design research. In the end it is unclear what the impact of the paper is, in terms of real changes in the practices of design researchers.

This is where authorship of such a critical paper comes with responsibility (in a sense it is too easy to write a paper in which questions are raised), and the paper should be accompanied by a commitment from the author to 'walk the talk', and actually set up a research program that does address the issues raised – if only to ensure that these questions cannot just be raised, but that they are also answerable. This paper offers up for discussion a research program and research centre that the author has set up over the last 5 years, as a prototype and proposition of a new model for design research.
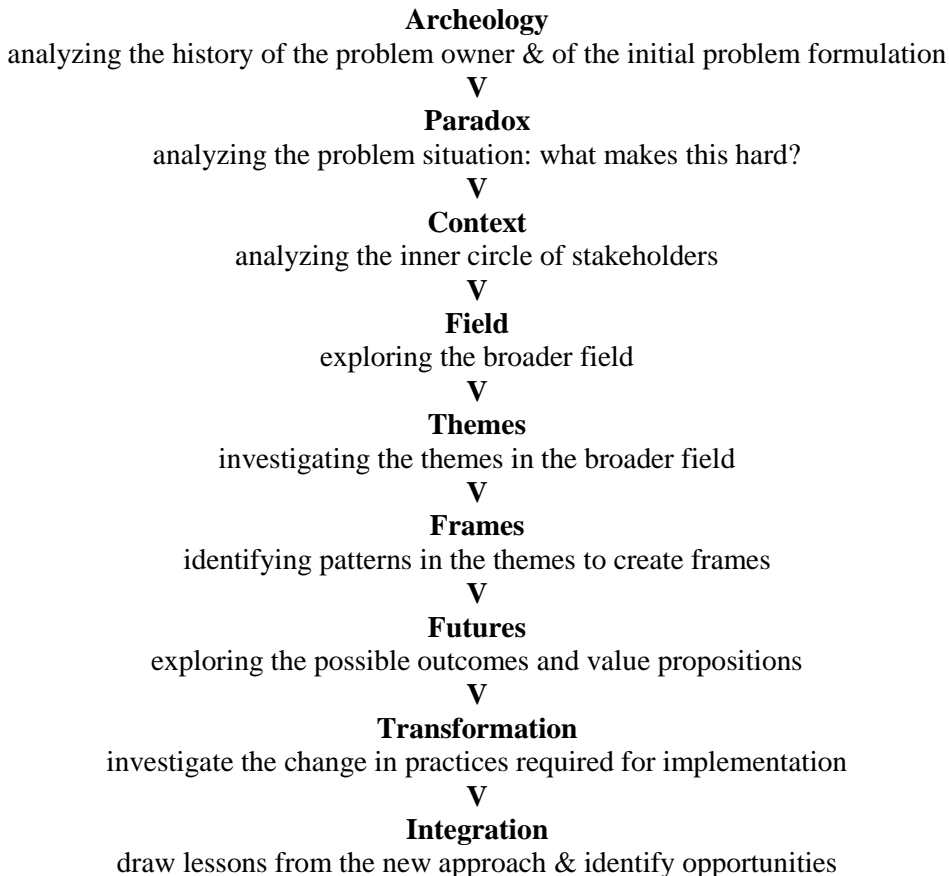

4   A PLATFORM FOR DESIGN RESEARCH

This paper report on the development of a design research program in Frame Creation, that is housed at the Designing Out Crime research centre at the University of Technology Sydney (Australia) and its counterpart at Eindhoven University of Technology (The Netherlands). In developing a new type of research centre that seeks to address the points raised in paragraph 2, we have had to resolve many more practical and fundamental issues than can be included in this brief paper.

4.1   Research program: frame creation

Many organisations find themselves powerless in the face of today's radically open, complex, dynamic and networked problems (Stacey et al., 2000, 2007). In search for new problem solving strategies, organisations and business schools have recently turned to the design professions ('Design Thinking' (Brown, 2009) (Martin, 2009) for help. Unfortunately, this interest in Design Thinking tends to be

limited to focusing on design practices that are aimed at generating solutions. This research program concentrates on another core quality of design practice, expert designers' ability to create new approaches to problems ('Frame Creation'). Through a combination of empirical studies into expert designers' practices, fundamental analysis (into reasoning patterns and different forms of rationality) and experimental practice a Frame Creation process model has been developed (Dorst, 2011). The Designing Out Crime research centres in Sydney and Eindhoven provide the initial real-world platform for performing crucial experiments in the development of a proper frame creation methodology. Observations from expert design practice have been interpreted and refined into an initial nine-step model of a frame creation process (see figure 1).

Archeology
analyzing the history of the problem owner & of the initial problem formulation
V
Paradox
analyzing the problem situation: what makes this hard?
V
Context
analyzing the inner circle of stakeholders
V
Field
exploring the broader field
V
Themes
investigating the themes in the broader field
V
Frames
identifying patterns in the themes to create frames
V
Futures
exploring the possible outcomes and value propositions
V
Transformation
investigate the change in practices required for implementation
V
Integration
draw lessons from the new approach & identify opportunities

Fig 1: The nine steps of the Frame Creation model

In this frame creation process, the oscillation between analysis and creation (co-evolution (Dorst and Cross, 2001)) that is central to design thinking is combined with a movement of zooming in and out (from the problem to the context and back again) and a shift in focus from the understanding of the core problem situation to widening the context, then back again to reframe by refocusing within a broadened problem arena. Central to these three movements is the fifth step where a phenomenological analysis (van Manen, 1990) leads to the basic themes from which new frames are created. The first four steps lay the groundwork, the last three steps explore the implications of the potential frames and the designs they could lead to.

Project example
As an example of this Frame Creation model in action, we will now turn to one of the first projects executed by the Designing Out Crime centre in Sydney (see section 4.2 for a description of this design research centre), dealing with problems in the city's entertainment district.
(1) Archeology - There have been continuous problems in King Cross, the entertainment quarter in Sydney. This area, with its bars and clubs and its slightly grubby nightlife attracts about 30,000 young people every Friday and Saturday night. All the activity is concentrated along a narrow 500 meter stretch of road where the big clubs and many bars are located. The problems that occur include

drunkenness, fights, petty theft (pickpocketing) and minor drugs dealing. Late at night, the situation often gets out of hand, there is sporadic alcohol-related violence and people do get hurt. Over the years, the local government has been trying to solve this problem by using these 'strong arm tactics', mainly through increasing the police presence and installing CCTV camera's. Clubs have been encouraged to hire more security personnel. All this visible extra security has now made the entertainment district a grim public environment, and while the number of arrests has increased, additional security measures don't seem to enhance public safety.

(2) Paradox – In initial research, designers from the Designing Out Crime centre quickly realized that the heavyhanded law-and-order approach didn't work at Kings Cross because there were no criminals: the people concerned are overwhelmingly young people wanting to have a good time. The problems might arise from the fact that this is a crowd of 30,000 young people

(3) Context - These parties include the police, club owners, the justice system, as well as people living in Kings Cross and the other stakeholders in the physical environment.

(4) Field - The broader field of possible stakeholders also includes educational establishments (schools, TAFE, Universities), teachers, parents, counselors, young tourists (backpackers), youth organisations, sports clubs, the 3FM radio channel, people living in the surrounding suburbs, transport providers (buses, taxi, train, etc), the tourist board, hospitals & care facilities, breweries, etc…

(5) Theme – Our research has shown that one of the deeper themes that is behind the youngsters behaviour at their age is 'identity'. They are very aware of each other and of an implicit moral code as they seek to position themselves in life through interaction in their particular social group. The way this works for the different groupings varies. Kings Cross is a place where this all comes together in an area that has very little structure to it.

(6) Framing - Using a metaphor (a 'frame') to help us understand the issue, one could say this situation could be compared to a good-sized music festival (30.000 young people on a festival terrain) – the fact that it happens twice a week is neither here nor there. To take this analogy further: how would one go about organizing a music festival? A well-run music festival would provide many facilities that are not available at all in the entertainment district, but that could easily be designed in.

(7) Futures - For one thing, when organizing a music festival one would make sure that people would be able to get there, but also to leave again when they wanted. In this entertainment quarter, the peak time of young people coming into the area is about 1AM, and the last train leaves at 1.20AM. Getting a taxi later in the night takes about 2 hours, if the driver wants take you at all (taxis tend to avoid this neighbourhood). So once you are in the entertainment quarter you are basically crammed into a single road until the trains start running again at 6 in the morning. That is ultimately very boring and frustrating. Apart from the obvious improvement of providing more trains, the designers also proposed as a fall back position a system of temporary signage on the pavement, to help party-goers reach a different train station (at 20 minutes walking distance) that has trains running throughout the night.

In organizing a music festival, one would also create chill-out spaces and offer continuous attractions to make sure that people will move around, so their experience does not completely depend on what takes place on a single big stage. As it happens, this entertainment district has a few big clubs that are the main attractions. But there is very little else. As a result, young people who have visited a club and go back out on the street might find that the queue for the next one is several hours long. If they decide not to join the queue, they are out in the street again with nothing to do. The designers proposed that problematic pattern of behavior can be minimized by providing a texting service or a smartphone app, so that people can find out how long the wait for the next club is before going out. In addition, some of the laneways around the central street could be prepared as rest areas, with water fountains and a relaxed "lounge" atmosphere away from the crowds.

An obvious thing one would provide for a music festival is enough public toilets. This particular entertainment quarter has only three, one of which is underused because it is located in a rather forbidding looking Police station. Consequently, there is a real street urination problem (not surprising if you calculate the amount of beer being drunk on a good night). Of course the designers proposed introducing a system of mobile toilet blocks.

Over the years, the clubs have hired more and more security personnel and bouncers as part of the conventional approach to solving the alcohol related crime and anti-social behavior issues. The designers proposed a system of very visible young 'guides' in bright T-shirts, who help people find their way through the area and who are also approachable when help is needed. This makes perfect sense: research has shown that people do not approach officials for help unless these officials are

approachable for other, low-threshold questions too. These bright and cheery Info people create a more caring social environment.

(8) Transformation – A prerequisite for all of these solution directions is that the City of Sydney takes the lead in becoming the 'organiser' of the metaphorical music festival, facilitating a process in which the key stakeholders (those from step 3 ("context") and as many as possible from step 4 ("field") will be brought together to structure the Kings Cross environment along these lines. For the City of Sydney to engage in this way, the creation of these new experiences should tie in with its broader strategic goals for the development of the city.

(9) Integration - The emergence of a 'path to action' in dealing with the city at night has led the City of Sydney to commission research on the present nighttime activity in the whole council area, followed by an extensive consultation process on the nighttime economy. This in turn has led to a multifaceted discussion paper, which was put forward in a new round of forum discussions with residents and other stakeholders. This resulted in a confident new strategy setting out how the city could respond through 100 concrete action points for the immediate, medium and long-term future. By entering into the process in this way, the City of Sydney has become an actor in the city in a completely new way. From being an infrastructure provider and sponsor of events, it has become an active force, as a curator or perhaps even conductor of life in the city. Very diverse groups of stakeholders (museums, pubs, etc) that have been folded into the process. The City of Sydney has not just reframed a problem but it has reinvented itself as a new type of actor in the city.

This frame creation model is a general framework for approaching open, complex dynamic and networked problems. But is nothing more than a bare backbone, there is much that needs to be fleshed out. The methods and tools to support achieving quality in all the nine steps are now the focus of research. The further critical development and detailing of this model into a true methodology is the focus for the frame creation research program. This research is intimately connected to the academic fields of Problem Solving (Dorst, 2006 and Simon, 1973), Design Thinking (Plattner, 2009) and Entrepreneurship (Sarasvathy, 2008) (Steyaert, 2007).
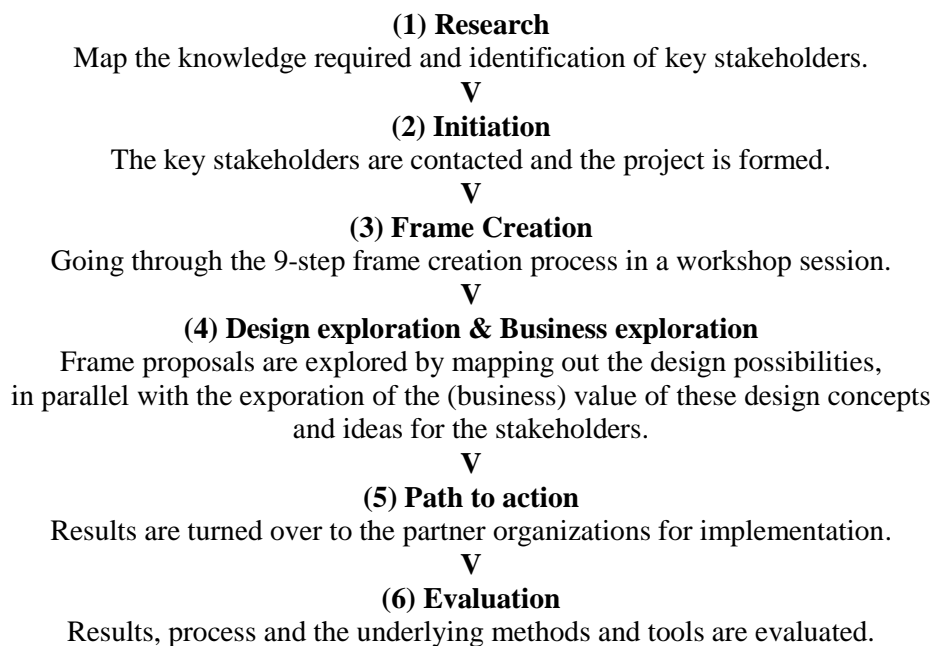
4.2   The DOC research centre model

In 2007 the New South Wales government's Department of Attorney General and Justice (DAGJ) and the University of Technology Sydney took the initiative to establish a Designing Out Crime research centre (DOC). Its remit is to use design practices to create innovative ways to deal with the need for safety and security in society (Lulham et al, 2012, Camacho Duarte et al, 2011). Since its inception, the DOC centre has delivered around 90 projects (by late 2012 – see www.designingoutcrime.com and www.designingoutcrime.nl for an overview). Central to the DOC approach is the pledge to avoid the creation of 'countermeasures' to crime. These countermeasures inadvertently remind us of the occurrence of crime - in the end making us more fearful and wary in public spaces, destroying the social fabric of our society.

The 90 projects bear witness to the fact that the frame creation process has been successfully introduced in the context of this particular kind of problems. The problems of dealing with issues of safety in public spaces are 'old' in the sense that the problem owners and other key stakeholders have over time already done what they could to improve the problem situation (often through the introduction of countermeasures). These kinds of problem situations are an ideal starting point for the frame creation process, as they clearly are in need of a new approach. The often long history of the problem means that the 'archeology' phase will dig up many earlier scenarios, giving an intimate picture of the existing frames and ways of working, as well as rendering a sophisticated and detailed view of what does NOT work in this problem situation. The 'old' problem context gives the DOC designers a clear problem situation and set of conventional solution strategies to push away from.

The DOC research centre operates as a network organization, with multiple activities taking place on the nexus of design and research, and on the nexus of academia, industry and government. The DOC projects are developed through six stages (see figure 2).

In this project model, steps 1-3 and 5-6 are performed by the professional staff at the DOC centre (a 50-50 mix of researchers and designers), often collaborating with postgraduate students (Masters students, as well as PhD candidates). The Bachelor students contribute mostly to (4), 'Design exploration & Business exploration'. Experience has shown that if the framing has been done well, the solutions that the undergraduate students generate will be interesting and useful. The centre staff and

professional associates to the centre monitor student projects and take the insights created to a professional level.

(1) Research
Map the knowledge required and identification of key stakeholders.
V
(2) Initiation
The key stakeholders are contacted and the project is formed.
V
(3) Frame Creation
Going through the 9-step frame creation process in a workshop session.
V
(4) Design exploration & Business exploration
Frame proposals are explored by mapping out the design possibilities,
in parallel with the exporation of the (business) value of these design concepts
and ideas for the stakeholders.
V
(5) Path to action
Results are turned over to the partner organizations for implementation.
V
(6) Evaluation
Results, process and the underlying methods and tools are evaluated.

Fig 2: The DOC centre engagement model

The DOC research centre is structured as a hub for applied research: an outward looking and flexible networked organisation where the academic and professional staff participates in the development of emerging ideas into business opportunities, as well as preparing publications for popular, professional and academic readerships. Presentations, publications and experimental designs are core outcomes of DOC. The developed design resources, tools and methodologies feed into structural impact through new curriculum development. DOC embodies a repository that includes case studies, publications produced by academic and professional staff as well as the research knowledge base on which they are drawing.

4.3   A new model for design research?
The questions raised in section 2 will now be used as a yardstick to assess the work of the research centre to date. To which degree could the research program into frame creation and the organization of the DOC centre be seen as a valid response to the issues in design research that were flagged in the 2008 paper?
On the first point (raised in 2.1) of the missing of an explanatory framework in much of design research, the frame creation research program addresses this indirectly by its experimental nature. In a very complex problem arena the execution of critical experiments is just about the only way to build up knowledge and create an explanatory framework. As an experimental research program the frame creation program is explicitly prescriptive (it cannot be anything else), but prescription is used as a lead into an action research cycle, as a way to keep questioning the nature of its assumptions. But one could argue that the real-life nature of these DOC projects makes precise and critical experimentation very hard, as the context cannot be totally kept under control and it is not always possible to achieve the quick alternation between description and prescription needed for a 'clean' experiment. Interestingly enough, the methods that are housed within the nine steps of the frame creation model are becoming more and more precisely honed to the (crime prevention) subject matter of the DOC projects. This comes from the rigorous and continuous testing of the overarching 9-step model and the methods and tools in them. By working in this way, the DOC designers are developing new processes that together form a complete new design practice (and thus move beyond the confines of just considering 'the design project').
On the second point of criticism (see 2.2), overwhelming process focus of much of design research, Designing Out Crime is doing well as it is establishing a new, complete design practice within the

field of crime prevention. In doing so, it is having to deal with the issues of the process, context, actor and the nature of the problem situation. It has to be both holistic in its approach to design practice and focused in its results.

Lastly, to address the point raised in 2.3, the link to developments in design practice is assured by DOC being part of the broader movements of 'social design' (for designers) and 'design thinking' (for influencing other disciplines, like management) and by the commitment in the center to see the projects through to concrete, on the ground results that work for the people of New South Wales. The frame creation model itself, while originating in the study of expert designers' working practices, potentially is a significant development in design practice as its explication allows designers to address whole new levels of complexity.

5   DISCUSSION AND CONCLUSION

In courageously taking on the challenges of experimental design (action) research projects in a complex social domain like designing for public safety, the DOC centre also has its challenges and limitations. The choice for the domain of public safety does limit the range and scope of the problems that DOC deals with, and thus the range and scope of the experiments for the development of the frame creation methodology. It is not always possible to perform the critical experiments that would be needed for the frame creation methodology development straight away – sometimes projects that are quite repetitive (from a methods development standpoint) have to be given priority as they concern a pressing crime issue. Yet the position and shape of the DOC centre, positioned between the abstract world of academic discussions and the real world of professional practice is an interesting one. Let us explore that position in some more depth.

Within the world of practice, changes in technology, society, culture and the business climate require companies and institutions to innovate. But even the innovative ones will always try to change as little as possible, so as not to squander resources. This tends to limit them to a short-term perspective, and most of them to small, incremental, evolutionary development. A university has the freedom to reflect deeper on the issues of practice, and to use its modelling capacity to deeper understand the changes that confront its industry and institutional partners. The models created are based on a mix of insights learned from practice and insights derived from the fundamental academic discussions. The core activity here is modeling. Most importantly the modeling allows us to create scenarios that express new possible futures for the field, not just dealing with extant situations and discussions but to develop scenarios that really project further into the future than professional practice can see. Thus DOC positions itself between the professional world and the abstract world of academic discussions. To take this position it has to run six processes in parallel: (1) learning the problems and issues from practice, concentrating on the changes in technology, society, culture and the business climate (2) learning from the discussions in various scientific fields (3) modelling practice with the help of these theoretical frameworks (4) reflecting on practice on the basis of these models (5) reflecting on theory based on these models (through academic papers into the 'parent disciplines'), and (6) crucially: creating longer sightlines into possible futures on the basis of these models. Any DOC project is built on these 6 processes.

In this way, the DOC centre positions itself between the world of academic discussions and the real world of professional practice. It takes its position at a university of technology as a locus for to combining knowledge from both sources, seek a deeper understanding and to build models that help shape the future. As it is wedded to design (an activity) as its core process, the choice for action research as its research methodology comes naturally. Yet it is worth realizing that this is certainly not the only new type of design research centre that has arisen over the past 5 years. Several universities have picked up on the need for a broader distribution of user-centered design skill and knowledge through the establishment of 'Living Labs' and 'Design Factories', delivering excellent tools for much deeper user understanding and user engagement. The DOC centre is special in its focus on creating new approaches to problems, but it is by no means the only or definitive solution to the quandary that was described 5 years ago. But it might be a new beginning.

REFERENCES

Brown, T., (2009) *Change by design*, New York, Harper Collins

Camacho Duarte, O., Lulham R., Kaldor, L., (2011) Co-designing Out Crime, CoDesign, International Journal of CoCreation in Design and the Arts, Special Issue: Socially Responsive Design, Vol. 7 (4)

Cross, N., (2004) Expertise in Design: an overview, *Design Studies* Vol 25, No 5, pp 427-441

Cross, N.G., (ed.)(1984) *Developments in Design Methodology,* Chichester, Wiley

Dorst, K., (2011) The core of 'Design Thinking' and its application, *Design Studies*, vol. 32

Dorst, K., (2008), 'Design Research: A revolution-waiting-to-happen', *Design Studies*, vol. 29, no. 1, pp. 4-11. (based on a keynote delivered at the IASDR conference in Hong Kong in 2007)

Dorst, K., (2006) Design Problems and Design Paradoxes*, Design Issues*, Volume 22, number 3 pp 4-17

Dorst, K., Cross, N.G., (2001) Creativity in the design process: co-evolution of problem-solution, *Design Studies* 22, pp 425-437

Dorst, K., (1997) *Describing Design - A Comparison of Paradigms*, PhD –thesis TUDelft

Hekkert, P., van Dijk, M.B., (2011). *Vision in design: A guidebook for innovators*, Amsterdam, BIS Publishers.

Lawson, B., Dorst, K., (2009) *Design Expertise,* Oxford, Architectural Press

Lawson, B., (1990) *How designers think: the design process demystified* (2nd ed), London, Butterworth

Lulham, R., Camacho Duarte, O., Dorst, K., Kaldor, L., (2012) Designing a counter-terrorism bin, In: Ekblom, P., (Ed) *From Research to Realisation: Designing out crime from products*. Crime Prevention Studies [Vol 27]. Boulder, Col., Lynne Rienner

Martin, R., (2009) *The Design of Business*, Cambridge MA, Harvard Business Press

Plattner, H., Meinel, C., Weinberg, U., (2009) *Design Thinking – Innovation lernen – Ideenwelten öffnen,* München, Mi-Wirtschaftsbuch, Finanzbuch Verlag [in German]

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

Sarasvathy S. (2008) *Effectuation – Elements of entrepreneurial expertise*, Cheltenham, Elgar

Schön, D.A., (1983) *The Reflective Practitioner: How professionals think in action*. London, Temple Smith

Simon, H.A., (1973) The structure of ill-structured problems, Artificial Intelligence, 4, 181-201, and in: Cross NG (Ed) (1984) *Developments in Design Methodology* Wiley, Chichester

Stacey, R., Griffin, D., Shaw, P., (eds) (2006) *Complexity and the Experience of Managing in Public Sector Organizations*, New York, Routledge

Stacey, R., Griffin, D., Shaw, P., (eds) (2000) *Complexity and management – fad or radical challenge to systems thinking?* , London, Routledge

Steyaert, C., (2007) Entrepreneuring as a conceptual attractor? A review of process theories in 20 years of entrepreneurship studies *Entrepreneurship and regional development* 19, nov 2007

Van Manen, M., (1990) *Researching Lived Experience*, Ontario, The Althouse Press

Verganti, R., (2009) *Design-Driven Innovation*, Boston, Harvard Business Press