

How I learned to appreciate our tame social scientist: experiences in integrating design research and the behavioural sciences

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Abstract: Designing solutions for complex behaviour change processes can be greatly aided by integrating insights from the behavioural sciences into design practice. However, this integration is hampered by the relative inaccessibility of behavioural scientific knowledge. Working in a multidisciplinary of design researchers and behavioural scientists may bridge the gap between the two fields. This paper shares our experiences in working as such a multidisciplinary group on a large project, amongst others consisting of the design of interventions for workplace safety. Our cooperation was fruitful, both for design researchers – being able to better structure the messiness of the design process –, behavioural scientists – gaining in ecological validity of their methods –, and commissioners – increased trust in potential outcomes of the design process. However, difficulties preventing synergy also transpired.

Keywords: behaviour change; theory-driven design; multidisciplinary design

1. Introduction

Using insights from behavioural sciences to inform designs for behaviour change is known to increase both the efficacy of the designs (e.g. Michie et al., 2009), and the decisional accountability of the designer (Van Woerkum & Aarts, 2012). However, designers and design researchers see the state of the art behavioural scientific debate as relatively impenetrable (Pettersen & Boks, 2008) and find it difficult to appreciate the merits and usefulness of different behaviour change theories and strategies (Klasnja, Consolvo, & Pratt, 2011).



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Working in multidisciplinary teams consisting of both behavioural scientists and design researchers might offer a solution to the problem of integrating these two fields.

The objective of this paper is to share our experiences of working together as a multidisciplinary group of behavioural scientists and design researchers, to identify areas in which we found synergy as well as barriers and thresholds that hindered seamless cooperation. To do so, we start out by contemplating differences in approach, methods and underlying assumptions in the fields of design and behavioural science, and then continue with introducing a design case from our collaborative project as an attempt to overcome these differences. We will discuss when and how the interaction of methods from design and science complement and augment each other, and present our experiences on the value of using designerly methods in the social sciences and vice versa.

1.1 A gap between the fields

Given the benefits of basing designs for behaviour change on theories and evidence from the behavioural sciences, it is not surprising that there has been a great increase in publications covering behaviour change in design research literature (Hekler, Klasnja, Froehlich, and Buman, 2013). A range of projects exists to integrate findings from the behavioural sciences in design research, (e.g. Oinas-Kukkonen, 2010; Lockton, Harrison, and Stanton, 2010a; Hermsen, Renes, and Frost, 2014). Similarly, the field of health psychology has seen a surge of behaviour change intervention projects that involve some degree of design¹.

However, a disconnect remains between the two fields that appears difficult to abridge. Findings remain largely siloed within the two communities, with substantial obstacles preventing synergy. Besides the practical level (paywalls, limited access, field-specific terminology), three reasons can be identified for this disconnect. Firstly, design researchers find it hard to appreciate the trustworthiness of the theory used, or of its applicability in the present situation, choosing to base their work on theories that are relatively well-known and appealing, but have been all but discredited in their fields of origin; such as the Theory of Planned Behaviour², e.g. in Coskun & Erbug (2014), and the Trans-Theoretical Model³, e.g. in Consolvo, McDonald, & Landay (2009); Nakajima & Lehdonvirta (2013); and Ludden & Hekkert (2014).

Secondly, we encountered that designers and design researchers are often unaware of their implicit views on how the users of their designs are going to use them (cf. Lockton, Harrison, & Stanton, 2010b). These implicit user theories more often than not see the user as either overly rational, capable of motivating behaviour change at the presentation of a single fact,

¹ E.g. Brown et al. (2014), on the design of a website to support smoking cessation; Direito, Jiang, Whittaker, and Maddison (2015) on the design of apps to increase physical activity; Horne-Moyer, Moyer, Messer, and Messer (2014) on the role of video games in therapeutic settings.

² Cf. Sniehotta, Pressau, and Araújo-Soares (2014) for an extensive critique on the Theory of Planned Behaviour.

³ Cf. West (2005) for an overview of critique on the Trans-Theoretical Model, with additional points made by Adams and White (2005) on the general lack of ecological validity in stage-based models of human behaviour)

or overly naive and easy to manipulate. Based on these implicit theories, designers tend to select existing theories that fit their purposes best, regardless of conflicting evidence – a process known as 'cherry picking'.

Finally, it is not at all uncommon in design projects that insights from desk-, literature- and user research are used only in a preliminary, ideation phase, as a source of inspiration (Hermsen, Mulder, Renes, & Van der Lugt, 2015). Later on in the design process, this knowledge tends to get cluttered by ideas, concepts and other design materials, which leads to designers relying solely on their 'gut feelings', which may very well contradict earlier findings from research.

This problem, of selecting an appropriate theoretical framework as a vantage point for design research projects and using this theoretical groundwork as an anchoring mechanism in the design process, might be overcome by working in a multi-disciplinary team, in which design researchers and behavioural scientists cooperate. Ideally, including behavioural scientists in a design research project could shed light on the merits and relevance of theories for the task at hand, and avoid cherry picking.

However, such cooperation is not without difficulty. Differences in approach, methodology, and view on what constitutes truth, hinder mutual understanding. For designers and design researchers, the starting point of an investigation into the desirability and feasibility of a behaviour change process is typically a holistic appreciation of the richness of a person's experience and acts (Cross, 1982; Sevaldson, 2010). The approach of behavioural scientists appears diametrically opposed to the designer's methods. Behavioural science is essentially reductionist in nature, attempting to establish the influence of single factors in controlled circumstances. This scientific method is especially powerful in falsifying invalid assumptions, i.e. knowing 'what *does not* cause what' (Cross, 1982).

Designers might feel that scientific modelling, the breaking down of complex situations in controllable sub-problems, is elusive. This approach might help the design process forward by providing a sense of grip on the problem by means of (over)simplification. Unfortunately, simplifications more often than not fail to do justice to the richness of real peoples' lives. Interestingly, behavioural scientists too are slowly becoming aware of the value of the context in experimental interventions (Tarquinio et al., 2015).

1.2 A multidisciplinary approach

Given the differences in methodology and ideas about truth finding, it is not self-evident that multidisciplinary teams can overcome these obstacles and come to a fruitful cooperation in which the whole is greater than the sum of its parts. In design research literature and elsewhere, there have, as yet, not been many attempts to investigate cooperative projects consisting of design researchers and behavioural scientists. This paper attempts to add to by reporting on our cooperation in a recent project.

In the past two years, we have been working together in a project that brings together participants from both academia – classical universities, technical universities and universities of applied sciences – and praxis – designers of products, services, interaction and visuals. The aim of the project, aptly named Touchpoints!, is to open up recent insights from behavioural sciences to designers for sustainable and healthy living.

Our endeavour distinguishes itself from most other efforts to integrate design and behavioural science, in that it is based upon a synthesis of meta-analyses of scientific behaviour change literature on basic principles for behaviour change. A second difference is that we attempt to deliver this knowledge in such a way, that it is not only usable in initial inspirational phases, but throughout the entire design process.

We worked in a mixed team consisting of service designers, design researchers from theory and praxis, behavioural scientists and visual designers. This means that the team is not grounded in a single discipline, be it behavioural sciences or design research, but we have had to find a collective grounding by means of bridging the gap between the two disciplines.

The project's first outcomes came in the form of theoretical groundwork: an extensive, evidence-based behaviour change model – the Persuasive by Design model (PbD, Hermsen, Renes, & Frost, 2014; Hermsen, 2015; Hermsen, Mulder, Renes, & Van der Lugt 2015; see figure 1). The model inspires designers to consider the distinction between automatic (impulse, habitual) behaviour and controlled behaviour; the former takes the form of a simple cue-response-chain, whereas the latter is more reminiscent of a thermostat, in which a person compares their own behaviour with a set goal, and given enough motivation, opportunity, and capabilities, regulates their behaviour. Early versions of the PbD-model utilized differently coloured layers to aid designers in informing their designs on various aspects of behaviour change theory; in the latest version of the model this relatively cluttered layer-based approach is translated into five key areas or 'lenses' (for an overview of the different versions of the model, see Hermsen, 2015). These five behavioural lenses offer insights into individual and social aspects of behaviour change. The five themes covered by the lenses are habits and impulses; knowledge, attitudes, and resistance; self-monitoring skills; motivation, capabilities, and opportunity; and persistently acting out the desired behaviour.

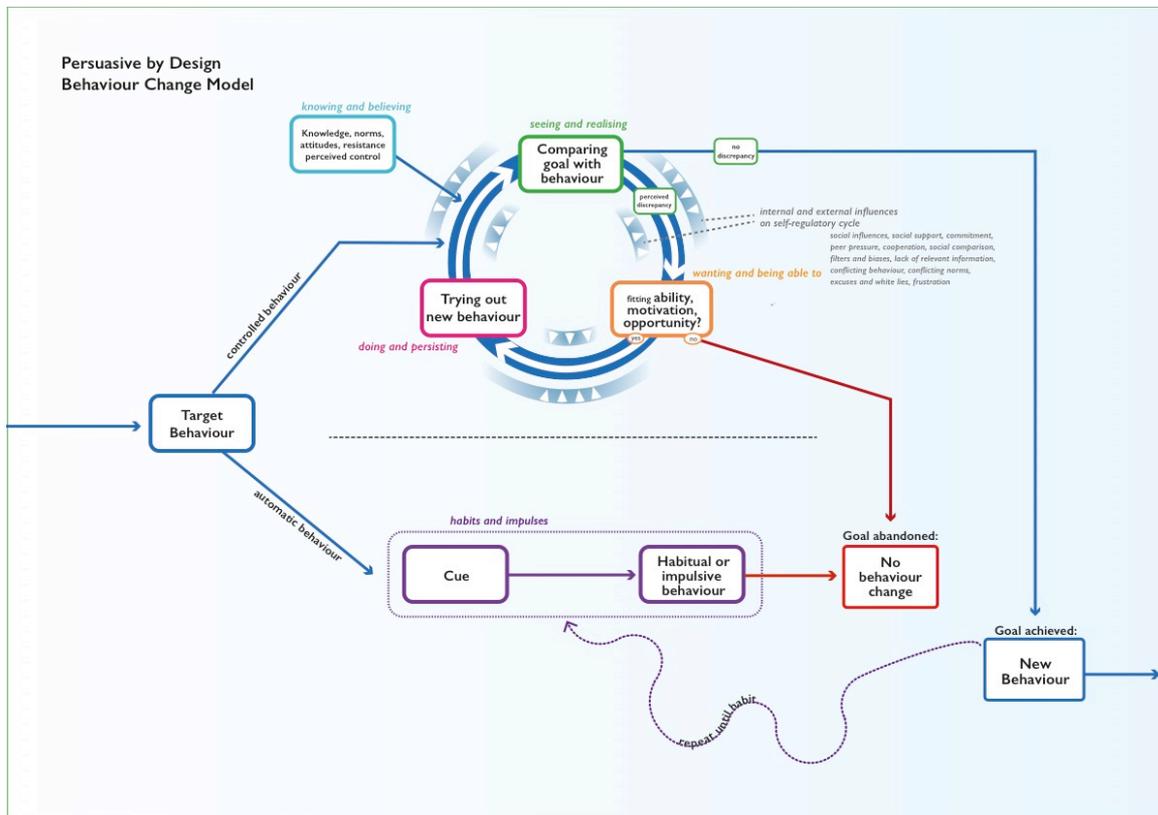


Figure 1: The latest rendition of the Persuasive by Design model

To open up the model's strengths to designers, we used it to inform the design of a suite of tools, ranging from a canvas to determine target behaviours for the change process, tools that allow for thinking about behaviour change in terms of the customer journey, to tools that provide links to much-used business building tools such as the Value Proposition Canvas (Osterwalder, Pigneur, Bernarda, & Smith, 2015). In developing these tools, we sought for ways that allow designers to develop behaviour change interventions that are scientifically informed. This theory-driven approach ideally leads to an enhanced decisional accountability, increasingly required by clients in both business and the public domain.

2. Design case 'safety behaviour at a gas plant', the intertwining of design and behavioural science

We will now present a brief design case as an additional way to convey what we have learned. This allows us to embed our findings in the practice of designing an intervention.

The Nederlandse Aardolie Maatschappij (Netherlands Oil Company, NAM) commissioned the Dutch service design bureau Mindmeeting to think of new interventions to encourage safe behaviour during maintenance work at a natural gas winning plant. During yearly overhauls the plant is temporarily taken out of order and NAM-workers and subcontractors do their maintenance jobs. NAM managers have taken measures such as signage to enhance the

safety of own personnel and that of subcontractors. Yet the NAM felt a fresh approach may lead to even higher standards of safe behaviour.

Mindmeeting specialises in creating learning processes for professionals. Given the opportunity to take a novel approach, they engaged behavioural scientists of the Research Group Cross-media Communication in the Public Domain of the Utrecht University of Applied Sciences to research and develop evidence-based interventions. The behavioural scientists, in turn, invited senior designers from three design agencies into the process.

To gain insight on the context, behavioural scientific researchers used a question set based on the PbD-model to set up structured interviews and meetings with stakeholders, to determine the needs and characteristics of plant workers and their managers. They documented current safety measures, e.g. existing signage at various NAM plants, and conducted literature research on safety behaviour. A crucial finding in this stage was a mismatch between NAM's current approach to encourage safe behaviour – providing knowledge – and insights from the behavioural sciences on factors that most aid such safe behaviour, such as safety motivation, job attitudes, stewardship, and the willingness to perform whistleblowing behaviour (Christian, Bradley, Wallace, & Burke, 2012). In other words, safety should be something 'owned and lived' by the workers themselves, rather than being imposed by an outside authority issuing rules the workers have to submit to.

Findings from this stage were used as input in a design pressure cooker meeting, where researchers of both denominations developed interventions to be implemented in a large plant maintenance overhaul (figure 2). The aim of the meeting was to come up with concepts for interventions to be implemented in a large plant maintenance overhaul. The conceptual design revolved around safety participation, safety motivation and improving group safety culture. Question sets based upon the PbD-model were used for brainstorming and concepting, to obtain focus and to translate abstract behavioural goals into feasible, quantifiable behaviours.



Figure 2: Design pressure cooker with design researchers, service designers, and behavioural scientists

Behavioural sciences' distinction between automatic and reflective aspects of behaviour proved useful in this phase. Much attention went into devising concepts that aimed at automatic behaviours such as habits and impulses. On the other hand, designerly techniques such as thinking in metaphors also proved fruitful. One example of such a metaphor is diving, where buddies take care of each other's safety after heavy training on automatic behaviours and habits applied both under and outside of the water. The diving metaphor resulted in an experiential intervention shaped like a gate that emphasises the transition from the 'safe' changing rooms to the implicitly dangerous working zones at the gas plant (figure 3).



Figure 3: A gate emphasizing the transition between the relative safety of the changing area and the relative dangers of the working zones. The exit to the relative safety outside the building site is visible.

Three interventions were developed. Firstly, as mentioned before, we designed a gate that makes the transition from the 'safe' changing rooms to the implicitly dangerous working zones tangible. Usually, this transition is passed through without noticing, which does not encourage taking the relative dangers of the workspace into account. The gate, which had to be passed in order to enter the building site, emphasized in its design exactly the relative dangers of the work space and the safety of the changing rooms. Secondly, we developed an intervention in which small groups of plant workers make a tour of the construction site and mark and report potentially dangerous issues on the building site, seen from their professional perspective, using a map derived from an aerial photograph (figure 4). These insights are then used for discussion in the next day's start-up meeting. Thirdly, we developed an intervention for plant safety trainings in which workers select a card containing a specific aspect of work safety from a deck. To encourage active responsibility for work safety, workers think through and discuss how this particular aspect of work safety relates to their work practices.

Limitations of the social psychological perspective became clear in our work, for instance in attempts to design a concept to encourage whistleblowing behaviour (which resulted in our second intervention). Whistleblowing behaviour is often very hard to perform because of underlying systemic factors: whistleblowing might lead to delays, which is seen as undesirable by both management and workers. Furthermore, whistleblowing is often framed as an act of an individual against the behaviour of another individual. Often to the

whistle-blower ends up being punished for his or her good behaviour. To overcome these systemic influences, we made sure our aforementioned intervention in which teams of plant workers mark and report potentially dangerous issues, encouraged stewardship and emphasized the professional role of the workers. Another intervention took place during training sessions, in which workers select one category of risks especially salient for their work from a set of potential risk areas and discuss possible prevention strategies (figure 5). This should encourage active responsibility for work safety.



Figure 4: An aerial photograph of the plant was used for daily safety tours performed by plant workers to identify potential hazards



Figure 5: Interactive training exercise, in which workers select a risk category that is particularly salient for their work, and talk about possible prevention strategies

To assess the efficacy of our interventions, we applied a range of assessment methods from the behavioural sciences. Not every assessment method proved effective. For instance, we used an attention-measuring paradigm often used in cognitive neuroscience: an oddball task, in which subjects have to detect, amongst a series of standard stimuli, an infrequent deviant one (Garcia-Larrea, Lukaszewicz, and Mauguière, 1992). To have workers participate in this oddball task, we constructed a booth outside and inside the gate, to compare response times in the task. We hypothesized that greater attention would increase reaction times inside the gate, but the distractions and the diversions of the real world on the workplace made this measurement infeasible. Similarly, an assessment of quality and quantity of various safety protocolling techniques, through which we hoped to assess a general increase of safety-related reports and a higher quality of safety-related feedback, was thwarted by the introduction mid-assessment of a new protocol registration form by management. Fortunately, a content analysis of safety meeting minutes, and feedback sessions from external safety quality assessment professionals, showed an increase in safety motivation behaviour, especially in participation in safety-related meetings.

3. Insights from our projects

The project, but especially the translation of the Persuasive by Design-model into something that designers for behaviour change find use for in their work, gave us valuable insights into how to connect design and behavioural sciences, disciplines that are quite distinct in methodology and underlying assumptions.

These lessons did not come easy; the differences between the disciplines sometimes made it hard to understand and appreciate the other's viewpoints. In hindsight however, this cooperation proved very fruitful. Participants from both disciplines – (participatory) design research and behavioural sciences – indicate that they have learned a great deal from each other's research methods and worldviews. The knowledge gained came from working gradually towards shared understanding about designing for behaviour change. As an added bonus, we found that the collaboration opened doors for design professionals into the offices of (mostly) governmental clients that hitherto were only opened for communication agencies, offering campaigns. Adapting a structured procedure of informing their designs by insights from behavioural sciences, helped designers overcome potential commissioners' insecurity about the uncertain results of the design process.

3.1 Similarities and differences

Our cooperation gave us insights in both differences and similarities between our fields. Similarities sometimes cropped up in unexpected form, when we found that similar concepts were used under different names in both fields.

One such similarity is the use of sensitization in participatory design and user research. Sensitizing users to the occurrence and effect of undesired behaviours increases the richness of the information users can provide in contextual interviews and other information gathering techniques. This use of prior stimulation to increase the availability of knowledge and behaviour is also widely used in the behavioural sciences. This technique is known as 'priming' and mostly applied in settings where automatic, often unconscious, behaviours are activated. Such findings of similarity lead to initial confusion, followed by increased understanding.

However, differences also occurred. Designers often adopt a pragmatic approach that is hard to accept for behavioural scientists. This focus on whether an intervention works, versus the focus on a concept's inherent truthfulness that is adopted by behavioural scientists, is a major cause of misunderstanding and lack of appreciation between the two disciplines.

This difference in focus can be illustrated by looking at how designers use personas (Pruitt & Grudin, 2003) to inform their design process. At first glance, the practice of constructing and utilizing personas appears to resemble the use of target groups in behavioural sciences. However, the primary use of individual information to the behavioural scientist is as a potential moderator of expected outcomes, i.e. to split target groups into subgroups. The usability of single person narratives to inspire the design of a concept is hard to grasp for behavioural scientist. Oftentimes they will question how large a target group each persona represents, while personas are not meant to be a representation of a group but meant to provide a reality check to see whether design moves make sense for at least some (more-or-less) real users.

3.2 The value of one discipline to the other

When applying insights from behavioural sciences has a valuable contribution to design, this value lies providing structure and grip on the inherent messiness of the situation that is to be improved. Utilizing a behaviour model has much to offer to add to the validity of design concepts, the extent to which the design achieves its initial purpose.

In the NAM-case described above, the PbD-model from our project functioned as a scaffold that prescribed the various stages of the design process. Using the model and the tools derived from it, enabled and eased the sometimes-difficult step from desk and user research to intervention design. Furthermore, it increased the internal consistency in the entire design process, which not only prevented cherry picking of seemingly practical chunks of scientific insight whilst ignoring inconvenient findings, but also meant a single line of reasoning – the notion that safe behaviour depends more on motivation and participation than on knowledge – could be held up and tracked from initial findings through operationalization of these findings to the evaluation of intervention effects. Perhaps this means the design process had less unexpected turns and less loose ends than is usual for a project of this scale. Most of all, it gave the client a sense of trust that these creatives ‘knew what they were doing’, and were more inclined to join them in this journey into the unknown.

Contrastingly, the value of insights from design for the behavioural sciences are invariably in the connection of theory and the real world, for instance in using visualisations and prototypes to move forward with incomplete or very complex information. Designing a prototype enables and structures thinking and discussing about complex realities, making it possible to envision the value of a theory in a rich context.

Furthermore, adopting a behavioural science approach often entails focusing on the level of the individual. In a design process, this means the designer runs the risk of losing a systemic perspective, which oftentimes has a large influence on the behaviour. In the NAM-case, this might have led us to design a promotion campaign for whistleblowing behaviour without considering the system and intergroup dynamics that counteract such behaviour. Such an approach certainly would have failed.

Finally, the case study showed that there is a need for practical, usable tools to evaluate the effect of designs for behavioural change in practice. Known measures from scientific laboratories are often too delicate and prone to disturbances when used in the field; current evaluation techniques from design research, however, are often not very rigorous and do not lead to valid and reliable measurements.

4. Conclusions

In the design case presented in this paper, our multidisciplinary approach was certainly effective, and led to valuable results for both design researchers and behavioural scientists.

The design researchers benefited from the possibilities for anchoring of the design process in theory and evidence the behavioural scientific approach offered; the behavioural scientists benefited from the increased ecological validity of the designerly perspective. If performed with care and consideration, a joint approach combining designerly methods with behavioural science can therefore greatly enhance the efficacy of the work of all parties involved.

However, differences transpired that might hinder synergy. Differences in what constitutes evidence and how truth is found can easily lead to unbridgeable differences in approach, makes it hard to value other's contribution. When working in multidisciplinary teams, therefore, it is paramount that all team members are attentive to moments when conflicting worldviews cloud cooperation.

The most surprising benefits of our cooperation were not for the design researchers or the behavioural scientists involved, but for their clients. Using an evidence base to evaluate insights from 'messy reality', and reflection of the internal validity and advancements of the design process, means that the integration of knowledge from science and user research does not stop at the ideation phase. The approach gives reluctant clients the much-needed confidence to engage in an open-ended process, which they might otherwise not be comfortable with. We have noticed that the combination of concrete concepts such as sketches and prototypes on the one hand, and the structuring scaffold of scientific theories and models on the other, reassures the client that the design process is well-structured and has a good chance of reaching depths of insight that were previously unattainable.

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