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Hermesen, Sander	Utrecht University of Applied Sciences, NL	sander.hermesen@hu.nl
Mulder, Sander	Utrecht University of Applied Sciences, NL Eindhoven University of Technology, NL	sander.mulder@hu.nl
Renes, Reint Jan	Utrecht University of Applied Sciences, NL Wageningen University, NL	reintjan.renes@hu.nl
Van der Lugt, Remko	Utrecht University of Applied Sciences, NL Delft University of Technology, Netherlands, The	remko.vanderlugt@hu.nl

ABSTRACT

Recently, there has been an increase in interest for the integration of insights from the behavioural sciences into the design process. The Persuasive by Design model aims to provide an evidence-based framework by which designers gain access to relevant theoretical insights from the behavioural sciences. This paper examines the use of the model in two case studies that dealt with complex behavioural change situations. In both studies, the model proved to be a valuable aid in determining target behaviours and operationalizing intervention concepts, especially in the early stages of the design process. Some shortcomings of the model also transpired. The model was seen as too complex, and its psychological frame does not prevent designers to overlook possible systemic moderators of behaviour. Implications for further development of tools that give access to model insights are discussed.

Keywords: behaviour change, persuasive by design, evidence-based design

1 INTRODUCTION

The process of designing solutions for behaviour change can be greatly aided by integrating insights from the behavioural sciences into design practice. Ideally, such integration leads to interventions that are effective at changing behaviour (Michie et al., 2009) and increase the decisional accountability of the designer (Van Woerkum & Aarts, 2012). Unfortunately however, although the field of design research has in recent years seen the publication of over 100 papers covering behaviour change, a disconnect remains between design research and service design on the one hand, and (cognitive and social) psychology on the other (Hekler et al., 2013). Designers often see psychological research as 'impenetrable' (Pettersen & Boks, 2008), and readily available models and theories that do make it into design practice tend to suffer from limitations in applicability (Hermesen, Renes & Frost, 2014). This leads to sub-optimal interventions that may not only fail at changing behaviours, but could even have an opposite effect on behaviour. For instance, the much-used Theory of Planned Behaviour (Ajzen, 1991) is known for its inability to deal with automatic behaviours such as habits (Sniehotta et al, 2014). Using this theory to inform the design of an intervention for habitual behaviour would lead to sub-optimal results.

This paper contributes to bridging the gap between psychological theory on the one hand, and design practice on the other, by examining the use and usability of a recent model of behaviour change, the Persuasive by Design-model (Hermesen, Renes & Frost, 2014). By studying two recent cases, we attempt to answer the question whether using the model facilitates evidence-based design of interventions aimed at changing behaviour.

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2 PERSUASIVE BY DESIGN-MODEL

Recently, a range of models and frameworks that aim to connect the fields of psychology and design have been presented in design research literature, all with their own specific area of expertise and merit (e.g; Lockton et al., 2013; Oinas-Kukkonen & Harjumaa, 2008; Zachrisson & Boks, 2012).

A recent addition is the Persuasive by Design-model (PbD-model, see figure 1). This model is unique in that it encapsulates meta-analyses of effective behaviour change interventions. Using the model enables designers to develop interventions informed by evidence from behavioural sciences, which aids both in increasing intervention efficacy (Michie et al., 2009) and in designer accountability (Van Woerkum & Aarts, 2012).

The PbD-model consists of three conceptual layers. A first, blue layer enables the designer to differentiate between designing for automatic aspects of behaviour, such as habits and impulses, and designing for reflective aspects of behaviour. A second, red layer pays attention to processes within the individual that threaten or otherwise influence behaviour change, and a third, green layer encompasses social influences on individual behaviour change. Two additional layers, a black layer aimed at interventions for reflective behaviours, and a purple layer aimed at interventions for automatic behaviours, aid designers in selecting an appropriate approach for intervention design. To access the layers and make use of the model, sets of questions are available (Question sets can be downloaded from <http://www.touchpoints-hu.nl/>). Answering these questions, if needed by means of additional design research activities, can provide designers with vital insights in the intervention's target behaviour and possible strategies for behaviour change.

We hypothesize that the use of the PbD-model facilitates effective use of theories from psychology to inform the design of behaviour change interventions that do justice to the complexity of everyday behaviour. Analysing how designers use this model in a real case delivers insight in whether designers are indeed supported in gaining access to relevant insights from cognitive and social psychology. Investigating the use of this model could also shed light on how insights from the behavioural sciences are used in the design process, where the benefits of using the PbD-model lie, and which shortcomings of the model can be identified.

3 METHOD AND RESULTS

To examine the way designers use the current model we performed a qualitative, explorative study in which we analysed the use of the model in two rich cases. Both cases aimed at encouraging behaviour change in complex professional practices, both including a change of behaviour of individual practice as well as a transition in organizational culture. Such cultural transitions are notoriously hard to achieve (Leeuwis & Aarts, 2011), which increases the need for well-designed, theory-informed interventions.

Sander Hermsen, Sander Mulder, Reint Jan Renes, and Remko van der Lugt

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For both case studies, the use of the model in the design process, the apparent benefits of model use, and shortcomings and difficulties that emerged, were analysed and reported. We compared the results of the analyses of the two cases and used our conclusions to synthesize directions for further development of design tools giving access to the model.

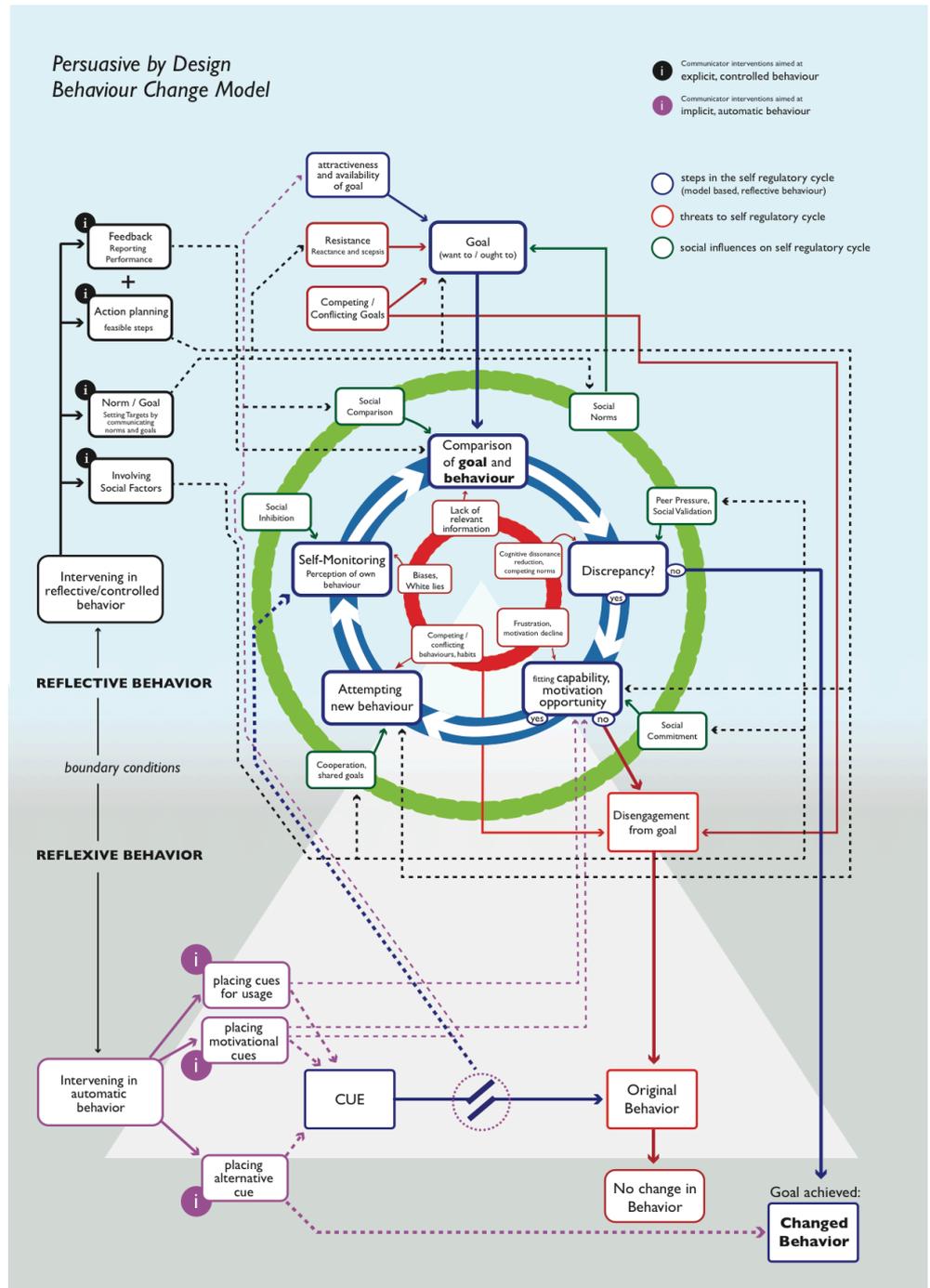


Figure 1 – the Persuasive by Design Model.

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3.1 CASE 1: FACILITATIVE BEHAVIOUR OF CIVIL SERVANTS IN PERMIT APPLICATION PROCESSES

3.1.1 *Introduction and method*

The first case was commissioned by the Dutch Ministry of Infrastructure and the Environment. In 2018, a large revision of the Environment and Planning-Act will be complete. The process of applying for planning permits needs to become faster and easier, both for civil servants and for applicants, entailing a change of culture in all layers of government. The *Design Innovation Group*, a design thinking agency that specializes in organisational change processes, were commissioned to develop interventions to encourage behaviours that streamline the application process.

To assess the application process and the possibilities for behaviour change, the designers applied a range of design research tools and techniques, including co-design sessions, a value proposition canvas, and an extensive process analysis. The designers reframed the original brief to active terms, seen from the perspective of the civil servant: *"give me something that helps me aid the applicant in submitting a complete planning permit application"*. This proposition was further translated into three target behaviours: to facilitate, to inspire trust, and to take responsibility.

A service blueprint was developed to map the target behaviours to the application process, showing where the desired behaviour was already present, where gaps in the current process existed, and where opportunities for behaviour change could be found. Subsequently, a series of interventions and tools were designed to enable structured and timely application submissions, such as a pre-set agenda, role charts, protocols for stand-up meetings, and interactive applications that provide information to the applicant.

We examined the use of the PbD-model in this case by analysing the designers' descriptions of the design process, the resulting interventions and the designers' own logged observations of their use of the PbD-model. Subsequently, we verified and elaborated our findings by performing semi-structured retrospective interviews with the designers.

3.1.2 *Results*

Designers used the model throughout the entire design process as a shared reference, e.g. by pointing out layers or elements of the PdB-model. One team member took up the role of 'guardian', i.e. repeatedly bringing elements from the model into the dialogue, in order to challenge the underlying assumptions and aim for more coherence of the designed interventions.

Early in the design process, the need for unambiguous target behaviours became clear. The model proved valuable in reframing and translating the brief to such concrete behaviours. Furthermore, the model's distinction between automatic and reflective behaviours led the designers to develop specific interventions targeted at each modes. Interventions aimed at automatic behaviour included advice to place high tables in meeting rooms that encourage standing up, and to go without serving coffee. Such interventions are thought to considerably speed up meetings. Interventions aimed at reflective behaviours

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included providing feedback and clear to-do lists, as suggested by the black layer in the model.

The model also proved valuable in the analysis of the permit application process, e.g. in determining where possible touchpoints for interventions could lie, and which behaviours should be triggered by the interventions at each touchpoint. However, from this point onwards the designers found the model rather hard to use, stating they kept 'getting lost in it'. One way the designers dealt with this, was to translate some of the model's insights from the black layer into simplified tools such as a bullet point list, which they found more clarifying. The designers also reverted to the use of additional frameworks to get a grip on target group motivations, such as Bateson's hierarchies of learning (Bateson, 1973).

The use of Bateson's hierarchies also hints at another shortcoming of the model. Whilst framing behaviour change processes in terms of behaviours of the individual has clear benefits, there are limits to this frame. For instance, zooming in on the level of the individual tends to increase the risk that impeding factors that stem from the socio-cultural and technological systems that underlie the behaviour are overlooked. In this particular case, service designers might want to question the assumptions underlying the desired behaviour change: is more facilitating behaviour really the answer here? The PbD-model does not aid designers to contemplate on more systemic transformative aspects.

Finally, the model appeared to be of more use in the early stages of the design process, and less so in later stages. The gathering and systematic analysis of information regarding current behaviour and processes, and focusing on concrete target behaviours, were aided by model use. However, in the development of intervention concepts, the model appeared to be of lesser value. Even though the black layer's elements were mentioned to be helpful by the designers, the model's complexity hampered application.

3.2 CASE 2: INCREASING SAFETY MOTIVATION AND SAFE BEHAVIOUR IN GAS PLANT MAINTENANCE WORKERS

3.2.1 Introduction and method

The second case was commissioned by the Nederlandse Aardolie Maatschappij (NAM) to Mindmeeting, a design firm specializing in creating learning processes for professionals. Mindmeeting was asked to design interventions that would provide plant managers with means to encourage safe behaviours. They engaged the Research Group Cross-media Communication in the Public Domain (Publab) of the Utrecht University of Applied Sciences to research and develop evidence based interventions. PubLab, in turn, invited three design agencies into the process.

Mindmeeting and Publab researchers assessed the scientific literature on factors moderating safe behaviour. Subsequently, they performed structured contextual interviews with stakeholders and gathered information by plant visits, interviews, collecting current materials used to encourage safe behaviour, and taking part in mandatory plant safety trainings. Findings from this phase were assessed using the PbD-model and relevant sources from literature. A crucial finding in this stage was a mismatch between NAM's current approach to encourage safe behaviour – providing knowledge – and insights from safety

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science on factors that most aid such behaviour, such as safety motivation, job attitudes, the willingness to perform whistleblowing behaviour etcetera (Christian et al., 2009).

Findings from this discovery phase were used as input in a design pressure cooker meeting, where Publab researchers were joined by designers from three service design firms to develop interventions for a large plant maintenance overhaul. Three interventions were developed: a gate that makes the transition from the 'safe' changing rooms to the implicitly dangerous working zones tangible; an intervention in which groups of plant workers mark and report potentially dangerous issues for discussion in morning start-up meetings; and an intervention in which workers select a card containing a specific aspect of work safety from a deck to encourage active responsibility for work safety.



Figure 2 – Transition gate into the 'unsafe' workspace

We logged and analysed the use of the PbD-model in the data gathering phase, in which we reviewed recent literature on factors moderating safe behaviour, gathered data through interviews with stakeholders and performed an analysis of current safety measures at gas plant locations. Subsequently, the use of the model in the design phase was registered through a blended process of action research and participatory observation.

3.2.2 Results

As said, the second case was conducted from a more participatory observation and action research perspective where the process was fed with research from the first and third author. In the preparatory phase, the model was used to set up structured interviews and meetings with stakeholders. The question sets accompanying the model were used to structure interviews and

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observations and played a role in determining the needs and characteristics of plant workers and managers.

Furthermore, the model's black and purple layers were used as a framework to categorize and analyse the diverse materials and interventions currently used by NAM to encourage safety behaviour. Based on the model, these were divided in informative interventions, interventions aiming at providing action plans, motivational / normative interventions, feedback interventions, and 'landscaping' (Pratkanis, 2007): interventions aiming to establish an environment in which safe behaviour is easily performed.

In the design pressure cooker, with, amongst others, the researchers and senior designers, the model and its accompanying question sets were used to aid and structure brainstorm sessions and concepting. Similar to the first case study, the target behaviours specified in the brief were too abstract and unfocused. Using the model, the design team was able to operationalize these abstract behaviours into specific sets of behaviours. Three of these were further developed into intervention concepts.

In this phase, the model's distinction between automatic and reflective aspects of behaviour proved useful. Much attention went into devising concepts that aimed at automatic behaviours. This resulted in an intervention shaped like a gate to enhance the feeling of transition into a possibly dangerous work environment. Similarly to the first case study, however, the model proved useful in the first stages of the design process, and less so in later phases.

Both designers and researchers had ample experience using the model in previous cases, so the complexity of the model was not seen as a limiting factor. However, during the design pressure cooker, still some shortcomings surfaced. In line with findings in the first case, the limitations of the social psychological frame provided by the model became clear in designing a concept to encourage whistleblowing behaviour. Such 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. To overcome these systemic influences that discourage whistleblowing behaviour, an intervention is needed that takes such systemic variables into account. The model does not aid such insights as of yet.

4 DISCUSSION

The two case studies showed that the Persuasive by Design-model is a valuable tool for the development of behaviour change concepts informed by evidence from the behavioural sciences. In both case studies, the model was particularly valuable in structuring and analysing user research. Both cases showed the model can be used as a framework to gather information on a variety of moderating factors, such as motivation and resistance, capabilities and opportunities to perform the desired behaviour change, and threats to the behaviour change process.

Furthermore, the model and its accompanying question sets were valuable in operationalizing concrete target behaviours. In both projects, the briefs provided by the commissioners were not specific enough to work with. As in most design

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projects, an indispensable step in the design process is the rephrasing of the proposed design problem. The model served as a useful tool in this stage.

A further benefit in using the model is that it makes 'landscaping', designs specifically targeting automatic behaviours such as habits and impulses, salient to designers. In both cases, specific landscaping interventions were designed.

However, as shown in previous research (Hermsen, Renes, Frost, 2014), the effective use of the Persuasive by Design model is hampered by its inherent complexity. This complexity emanates from the underlying theories of behaviour change, thus enabling the designer the creation of evidence-based interventions, but, as a consequence, the model is not easy to use. Designers in the first case study did indeed report this complexity to be problematic. The second case study does not corroborate these findings, but the second case design team was well acquainted with the use of the model from earlier projects, which made usage easier.

In both cases, designers took steps to overcome framing limitations brought about by model use. Adopting a (social) psychological approach to behaviour change is often fruitful, because it favours focusing on individual behaviours. However, behaviours are often caused or sustained by systemic factors such as group cultures, rules and regulations, and organizational culture (Leeuwis & Aarts, 2011), which can make behaviour change very hard. To make sure individuals can change their behaviour, often a systems level change is needed. The model in its current form does not support zooming out to such systems levels.

Both cases show that the model is used more extensively in the early stages of the design process. This could imply there is more need for such tools in these stages, but it could also mean the current form of the model makes it less suitable for use in later stages. Model layers especially meant for application in this later stages, i.e. the black and purple layers, may need some extra scrutiny since their current form may be limiting or not inspiring enough.

5 IMPLICATIONS FOR FURTHER RESEARCH AND DESIGN TOOL DEVELOPMENT

Further research on the development and use of the Persuasive by Design model should be dedicated to enhancing the strong points and reducing the limitations raised by the two case studies described here.

A first step should be aimed at overcoming the difficulty in using the model. Solutions may lie in a different design, for instance by taking layers apart or adopting a presentation form that allows users to gradually walk through the model. Another solution may lie in translating the model into tools designers can use, preferably without compromising their regular design methods, and without losing sight of behaviour complexity.

One such tool could aim at operationalizing concrete target behaviours. This is already seen as a strong point of the model and could do with further enhancement. A tool to further structure thinking about (chains of) target behaviour(s), operationalizing them from abstract to concrete should also take into account the 'zooming' problem described above. Enabling designers to think

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about the underlying systemic factors governing individual behaviours helps them in overcoming possible weaknesses of the social psychological focus of the model.

A further tool could aid designers in mapping the diverse psychological processes included in the model to the target behaviours, both in terms of threats and opportunities. Such a tool could help designers question the viability of different approaches to behaviour change: how does this intervention deal with resistance to change? How does it give users the abilities and opportunities needed to change their behaviour?

The model's black layer, concerning reflective behaviour, seems to be its least clear part; this may be a primary cause for the fact that the model is underused in later stages of the design process. The current form of the black layer, four main 'ingredients' connected to the other layers by a series of arrows, is seen as confusing, because of the complexity of the boxes-and-arrows setup. Furthermore, because the layer displays only four possible directions for intervention strategies, the layer also limits creativity. A better alternative might be to provide users with a list of possible 'active ingredients' for behaviour change interventions, with references to which part of the behaviour change process they influence. The behaviour change taxonomy provided by Michie et al. (2013) would be a good evidence-based framework for such an 'ingredient list'.

The case studies described in this work also give rise to new questions that need further research. Especially the notion that the model is used more heavily in early design stages needs further scrutiny. If the model gets more accessible, does that mean it will be used more in later stages? Or do designers at that stage have less use for behaviour change theory models?

Finally, the question remains open whether the use of this model, or indeed any psychology-based model or framework, actually leads to better interventions that achieve larger behaviour change, or change that is easier to achieve. The overall aim of using scientific evidence to inform behaviour change interventions is to contribute to healthier and more sustainable behaviour. This is a claim that remains as yet to be tested.

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