PERSUASIVE BY DESIGN: A MODEL AND TOOLKIT FOR DESIGNING EVIDENCE-BASED INTERVENTIONS

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ABSTRACT
Despite increased interest in applying psychological theory to the practice of designing behavioral change interventions, design professionals often lack adequate knowledge and resources to do so. In this paper, we present a tool to help professionals in the creative industries design evidence-based health interventions, the Persuasive by Design model. This paper describes the contents and application of the model as well as plans for further development and testing.

Author Keywords
Model; design tool; persuasion; design; evidence-based; interventions; persuasive technology.

ACM Classification Keywords
H.1.2 User/Machine Systems: *Human factors*

INTRODUCTION
Recent design research literature indicates an increased interest in applying insights from psychology and related sciences to design behavioral interventions. This interest spans the fields of sustainability (e.g. [1]), health (e.g. [2]) and mobility (e.g. [3]). So called "evidence-based" interventions have been shown to be both more effective at changing behavior [4] and to result in great increases in the decisional accountability of the designer [5].

Despite interest in applying current psychological theory to design practice, a disconnect remains between the fields of design research and service design on the one hand, and (cognitive) psychology on the other. Designers often view cognitive psychology research as "impenetrable" [6]. The psychological theories and models in current use within design suffer from limitations. Existing theories, such as Theory of Planned Behavior [TPA, 7], the Health Belief Model [HBM, 8] and the Fogg Model [9] do not address all aspects of behavior, and offer a limited view of persuasive interventions. These shortcomings may severely reduce the potential efficacy of any designed intervention based on these models. In this project, we propose a behavior change model to inform the design of evidence-based interventions. In this paper, we discuss the model, its practical application and plans for further development and testing.

PERSUASIVE BY DESIGN MODEL
The model includes both the contexts and intervention strategies for the intervention, displaying them in a set of color-coded layers and suggests a series of questions to help the designer address each aspect of the target behavior. The three contextual layers include: a blue layer with two different modes of behavior (reflective and automatic), a red layer that displays biases and other internal threats for behavior change, and a green layer displaying the social influences on our behavior. The two intervention layers include: a black layer that displays methods to change reflective behavior and a purple layer with strategies to target automatic, reflexive behaviors.

The proposed model improves upon existing tools to inform the design process in a few ways. Firstly, the model offers a broader range of possibilities for persuasive intervention design than TPA, HBM or the Fogg Model. Secondly, the model reflects current thinking on behavior. It takes into account the observed dichotomy between reflective and reflexive behaviors, and explicitly incorporates social influences and cognitive biases. Lastly, the layout and presentation of the model is designed for intuitive use.

DEVELOPING PERSUASIVE INTERVENTIONS
To introduce the model to creative industry professionals, we developed a workshop in which the model is presented. In this workshop, we introduce the elements of the model and the sets of questions associated with each one. Participants use the model and the questions to analyze target behaviors and select an appropriate strategy for the design of persuasive interventions.

Reflexive and reflective modes of behavior (blue layer)
The foundation of the model (fig. 1, blue layer) reflects the notion that most of our behaviors are executed in one of two modes: either automatically or with reflection.

The reflexive, automatic system acts upon the (often unconscious) perception of a cue, which turns on a habitual routine that leads to behavior. This system is fast and efficient, but because its execution is based upon prior experience without adaptation to the current situation, it is not always effective.

Reflective behavior, on the other hand, is best viewed as a self-regulation cycle reminiscent of a thermostat [e.g. 5, 12]. We compare our goals to current behavior. Upon noting a discrepancy, given enough motivation, ability and opportunity, we change our behavior, monitor our changed behavior, compare once again our current behavior to our goals and so on, until our goal is reached. This reflective mode is cognitively costly in that it requires conscious effort.

Viewing this foundational layer, the blue layer, triggers designers to think about the qualities of the target behavior or – in most cases – the chain of target behaviors. For instance, to develop an intervention to reduce shower length and save water, the question set derived from this part of the model suggests how developers should differentiate between an initial phase in which adaptation of the intervention is the goal, followed by an implementation phase where the actual behavior change takes place. For each separate link in the target behavior chain, the question sets and the model[1] inform the design of the intervention.

Of course, many of our behaviors are complex and engage both systems [10]. A set of questions in the model focuses designers on what aspects of the target behaviors are automatic in nature, e.g. habits and impulses, and which aspects are reflective.

The model also presents users with opportunities for increasing reflection about otherwise automatic processes. Behavioral research suggests that automatic behavior such as taking a shower every morning can be influenced by offering new cues or hiding undesired ones, for instance by setting favorable defaults [11]. When this is impossible or not ethically viable [12], automatic behaviors can be interrupted for reflective change, e.g. by giving feedback on habitual behavior. The purple layer of the model illustrates the possibilities for intervening in automatic behavior. In the case of the shower intervention, a visible cue can make the time spent in the shower tangible, thereby disrupting habitual behavior.

To sustainably change reflective behavior, the model suggests keeping goals and norms salient, offering feedback

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[1] A full set of questions accompanying the model is available from http://www.touchpoints-hu.nl/

on current behavior and providing action plans [13], as displayed in the model's black layer. Take the case of how to design an intervention to reduce home heating energy use by promoting roof insulation. The black layer in the model indicates the utility of social norms to change behavior. Designers, viewing the model, might then create a searchable color-coded heat map visible at the level of individual homes.

Threats to reflective behavior change (red layer)
Everyday experience teaches us behavior change is not as easy as simply following the proposed self-regulation cycle until we hit upon success. The red layer in the model displays the many threats to behavior change that may occur.

For each target behavior, possible deficiencies, biases and other threats to behavior change can be considered by answering corresponding questions. The red layer and the accompanying questions enable designers to reflect on these threats. Is the way the intervention is set up prone to induce resistance in the target group? Is the target group capable of judging their own behavior? In the example of an intervention to reduce energy consumption, the barrier to change behavior may be awareness. The heat map would make the consequences of poor roof insulation visible to the consumer.

A further group of questions included in the model addresses motivation, ability and opportunity to implement new behavior. These may provide barriers that prevent behavior change and are more often than not the weakest link in a designed intervention. In the heat map example, intervention designers may through answering these questions realize that even though the heat map makes it possible to experience roof heat loss, which can provide clear motivation to save both money and energy, perceived barriers such as cost and effort may seem too big to make behavior change possible. The black layer of the model suggests the intervention should offer an action plan fitting to the feedback. To remove felt barriers, designers may decide to include attic clearing services for a minimal extra fee in the intervention or display direct connections to available funding.

Social influences (green layer)
An effective model of behavior change should also take into account the fact that humans are social beings, not autonomous entities oblivious to social influence [14]. The green layer in the model reflects social influences on the reflexive cycle.

To attend to social influences, the model includes a set of questions about the influence of social processes in all their complexity. While social comparison can be a powerful motivator to change, finding out you are doing better than your peers can impede performance. Similarly, social commitment and peer pressure may enhance motivation to take part in energy saving measures, but social validation –

everybody has this problem, so why should I bother to change this – may decrease said motivation. When designing an intervention for example, to save energy, these social processes need to be taken into account. The green layer in the model and the answers to the accompanying questions enable designers to build interventions that benefit from social influences and avoid undesirable effects.

DEVELOPMENT AND TESTING
A first version of the model was based on an extensive review of recent behavior change literature, followed by two co-design sessions in which we introduced drafts of the model to professionals from the creative industry. These sessions enabled us to do some fine-tuning and led to the conclusion that because of the inherent complexity and nuances of this model, we also need to craft a proper introduction and background explanation.

For this reason, we developed and tested a workshop during three field sessions. Two of these sessions were aimed at developing interventions to reduce car use at rush our times, with a total of eight participants working on four different concepts. Another session, with twelve participants, was held at a large energy-distribution company, where an intervention is being developed to reduce the CO2-footprint of their fleet of service vans.

Questionnaire results, interviews and participatory observation during the workshops revealed that participants were enthusiastic about the model and the insights provided. Participants were confident about its usefulness both in developing the current concepts the workshop helped developing and in future work. Both questionnaire results and observations showed that after the introduction, participants were able to better identify strengths and weaknesses of their concepts and improve their concepts accordingly.

Research plan for further development and testing
In the months after this conference, we will prototype and test a further interactive version of the tool. This version will enable participants to use the model without having to participate in a time-consuming workshop setting. This tool will be tested in further co-design sessions with design professions in which we provide the tool and ask them to design an intervention to address a real-world problem. We will employ participatory observation and qualitative research methods to evaluate the utility of the tool in these sessions. Finally, we will test the model in an experimental setting, comparing the tool's effectiveness with other existing models and tools.

REFERENCES
1. Zachrisson, J., & Boks, C. (2012). Exploring behavioral psychology to support design for sustainable behavior research. *Journal of Design Research*, *10*(1), 50-66.
2. Michie, S., Ashford, S., Sniehotta, F. F., Dombrowski, S. U., Bishop, A., & French, D. P. (2011). A refined taxonomy of behavior change techniques to help people change their physical activity and healthy eating behaviors: the CALO-RE taxonomy. *Psychology & Health*, *26*(11), 1479-1498.
3. Jylhä, A., Nurmi, P., Sirén, M., Hemminki, S., & Jacucci, G. (2013, September). Matkahupi: a persuasive mobile application for sustainable mobility. In *Proceedings of the 2013 ACM conference on Pervasive and ubiquitous computing adjunct publication* (pp. 227-230). ACM.
4. Michie, S., Abraham, C., Whittington, C., McAteer, J., & Gupta, S. (2009). Effective techniques in healthy eating and physical activity interventions: a meta-regression. *Health Psychology*, *28*(6), 690.
5. Van Woerkum, M.A., Aarts, N., (2012). *Accountability: New challenges, new forms.* Journal of Organisational Transformation & Social Change, Volume 9, Number 3, November 2012 , pp. 271-283(13)
6. Pettersen, I., & Boks, C. (2008). User-centred design strategies for sustainable patterns of consumption. In T. Geer Ken (Ed.), *Proceedings: Sustainable Consumption and Production: Framework for action, Brussels, Belgium. Conference of the Sustainable Consumption Research Exchange.*
7. Ajzen, I. (2011). Theory of planned behavior. *Handb Theor Soc Psychol Vol One*, *1*, 438.
8. Rosenstock, I. M. (1974). The health belief model and preventive health behavior. *Health Education & Behavior*, *2*(4), 354-386.
9. Fogg, B. J. (2009, April). A behavior model for persuasive design. In *Proceedings of the 4th international Conference on Persuasive Technology* (p. 40). ACM.
10. Dolan, R. J., & Dayan, P. (2013). Goals and Habits in the Brain. *Neuron*, *80*(2), 312-325.
11. Verplanken, B., & Wood, W. (2006). Interventions to break and create consumer habits. *Journal of Public Policy & Marketing*, *25*(1), 90-103.
12. Verbeek, P. P. (2006). Persuasive Technology and Moral Responsibility Toward an ethical framework for persuasive technologies. *Persuasive*, *6*, 1-15.
13. Gardner, B., Whittington, C., McAteer, J., Eccles, M. P., & Michie, S. (2010). Using theory to synthesise evidence from behaviour change interventions: the example of audit and feedback. *Social science & medicine*, *70*(10), 1618-1625.
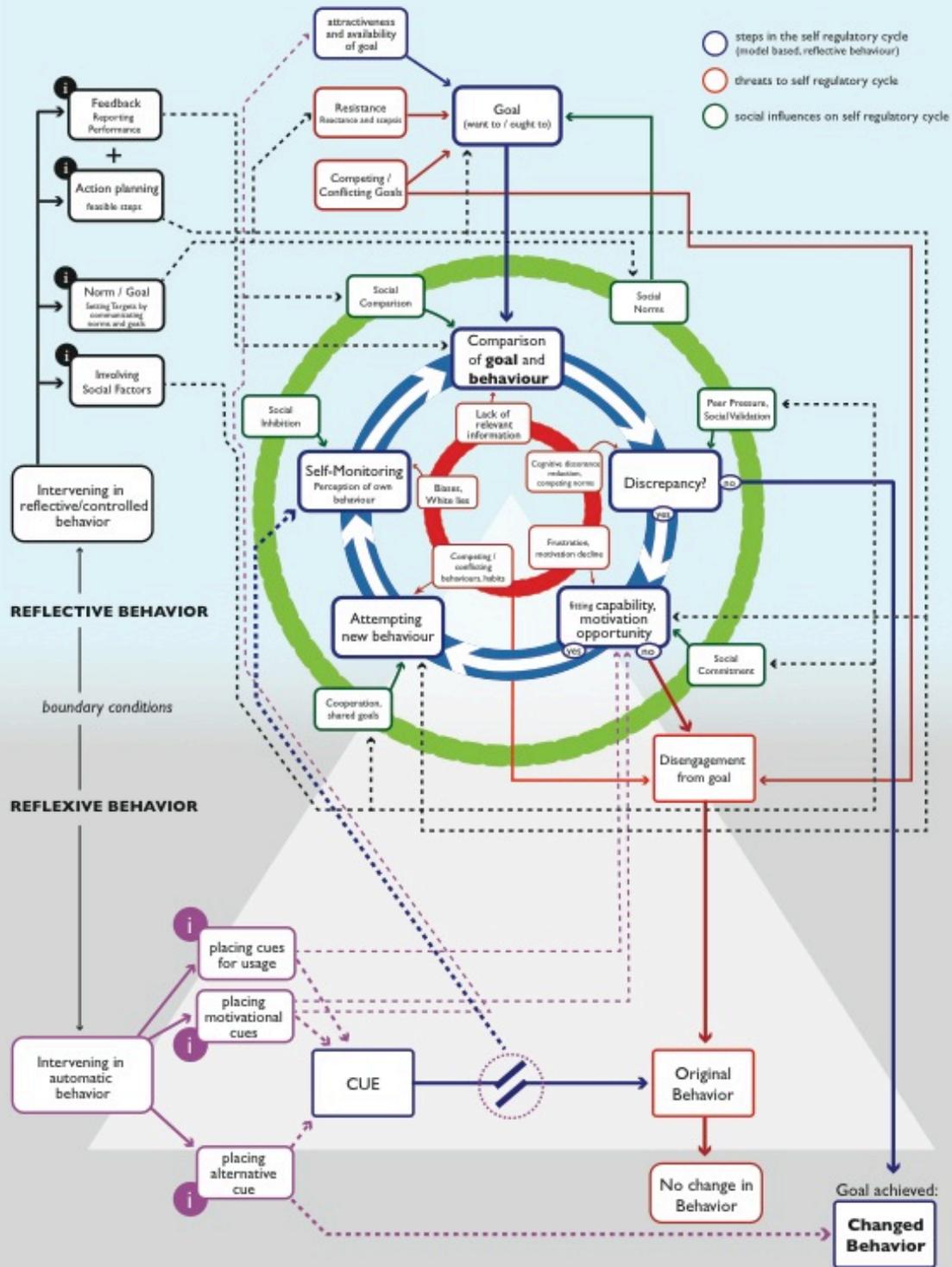14. Lewin, K. (1939). Field theory and experiment in social psychology: Concepts and methods. *American journal of sociology*, 868-896.

fig. 1: The Persuasive by Design-Model