Triggers in the environment

Increasing reach of Behavior Change Support Systems by connecting to the offline world

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Abstract. Behavior Change Support Systems (BCSS) are a category of persuasive systems that can potentially help large groups of people to change their behavior. Within this category, many systems have been introduced aimed at helping people to lead a healthier lifestyle. However, many such systems do not reach all people that could benefit from using them. With reference to Stages of Change theory, this article discusses why current approaches to increase reach have been less than successful. Further, we provide an alternative approach to increase reach; design for stages of change. Following this design approach, we argue that triggers in the environment can increase reach for BCSS. A case study serves as an example of how designers can design interventions following the approach while connecting triggers in the environment to BCSS. A preliminary user study showed that connecting a BCSS to a trigger in the environment is a promising avenue to increase reach. In our discussion, we will elaborate on future avenues for research on triggers in the environment and the design of dynamic interventions.

Keywords: persuasion, stages of change, BCSS, reach, design

1   Introduction

Behavior change support systems (BCSS) have been introduced as a key construct for research on persuasive systems design, technologies, and applications (Oinas-Kukkonen, 2010). As a possible response to the severe problems that our society faces when it comes to securing health for the public at large, many of such systems have been introduced that aim to help people to adopt a healthier lifestyle. Among these are, for example, systems that aim to improve dietary behavior or to increase the amount of physical activity that people take every day (e.g., Consolvo et al., 2008). BCSS can potentially be used by large groups of people because they are easily ac-

cessible, not overly expensive and mostly convenient to use. However, BCSS often suffer from a lack of reach: most BCSS reach a limited group only, in many cases mainly highly educated women (Kelders et al., 2011), suggesting that, that in spite of their large potential, web-based interventions miss out on helping the public at large. This selective reach is not intended and in many cases it seems to strengthen the 'inverse care and information law' (i.e. people in urgent need for care are the ones who are least likely to receive care (Eysenbach, 2000; Tudor Hart, 1971).

Attempts to increase reach of BCSS have often followed the strategy of personalization. Personalization of the content or of the aesthetics of a BCSS offers opportunities to attract different target groups. The BCSS Chick clique, for example, (Toscos et al., 2006) was designed especially to be attractive (in content and system to teenage girls. Personalization can also be used to adapt the BCSS to the needs of different groups of people. Kaptein et al, (2012) for example, measured susceptibility to persuasion and studied effects of tailored, persuasive text messages to reduce snacking. Results showed that tailored messages lead to a higher decrease in snacking consumption. Personalization of a systems functionalities and content can thus attract different target groups and improve people's satisfaction with services. In this paper, we would like to introduce an alternative design approach to increase reach: that of placing *triggers* in the environment. In his behavior model for persuasive design, BJ Fogg (2009) mentions *triggers* as one of the three principal factors that are essential for a behavior change to happen. In their work on Persuasive Systems Design, Oinas-Kukkonen & Harjuuma (2009) postulate that persuasion is often incremental and that it is easier to initiate people into doing a series of actions through incremental suggestions. We see triggers as doing just that; A trigger can be a first reason to start a series of actions leading to behavior change. Using theory on stages of change, we will show that most BCSS currently attract people who are already to some extent motivated to change, thereby failing to reach the large groups of people who are unaware of a need for change. We will argue that placing triggers in the environment can be a successful strategy to reach these groups of people. The paper will go on to show a design case study that introduces a range of products that are connected and that help people move through the different stages of change. We will report on a preliminary user evaluation of this case study that indicates that placing a triggers in the environment and connecting this trigger to a personal BCSS is a promising strategy to increase reach.

2   Design for stages of change

In their work on health behavior change, Prochaska and colleagues (Prochaska et al., 1992; 1997) identified 10 distinct processes of change. When they presented these processes to their research participants, these reported that they used different processes of change at different times, thus revealing that behavior change follows a series of stages. These findings eventually led to the development of the Transtheoretical Model of Health Behavior Change (TTM). Prochaska et al. suggest that to make a durable health change, whether it is to quit smoking, to eat a more healthy diet or to increase physical activity, people pass through five stages: precontemplation, contem-

plation, preparation, action and maintenance. In the first three stages, people built motivation to change and in the last two stages people act. Following this theory, health interventions should have different goals for people who are in different stages of change. While interventions aimed at early stages of change should aim to raise awareness, interventions in later stages should be more focused on acting out and sustaining new behavior. Based on an analysis of health interventions aimed at eating a healthier diet or at increasing physical activity, a framework was created for the design of stage-matched interventions (Ludden & Hekkert, 2014). This framework (see Figure 1) is largely based on the TTM, including processes of change and stages of change while connecting these to design strategies for stage-matched interventions. Four types of design strategies have been defined that adhere to four different (design) aims: 'raising awareness', 'enabling', 'motivating' and 'fading out'. As can be seen from Figure 1, the design strategies spread over multiple stages.
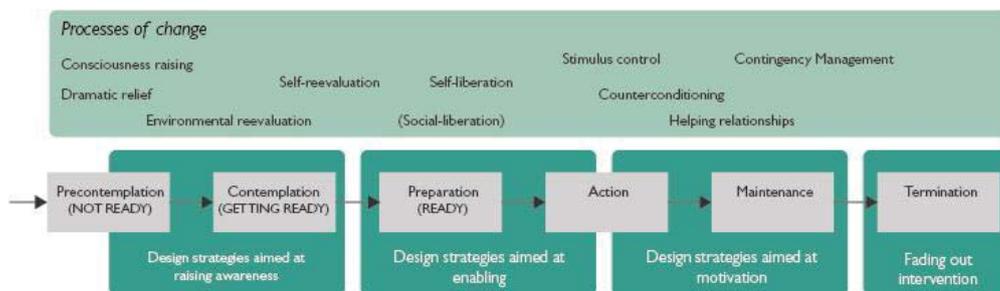
Fig. 1. The 'design for healthy behavior framework' connecting processes and stages of change to design strategies.

Most BCSS focus on particular phases in a behavior change cycle; that of action and motivation. However, when it comes to leading a healthier lifestyle, many (most) people are in earlier stages of change (Kramish Campbell et al., 1999). Most likely, these people will not feel the need to buy or use any of the numerous devices or applications on the market that support adopting a healthier lifestyle.

Therefore, placing triggers in the environment, that everyone can (and will) encounter are essential to adopt BCSS and to start a process of change. People need to become aware of the consequences of their choices and, as a second step, they need to be made aware of their possibilities for action. While presenting a design case, we will show how a trigger in the environment can serve as an enabler of changes towards a healthier lifestyle.

3   Design case: sugar to water

A design case was carried out to serve as an example of how to design an intervention that people come across in their physical environment as a trigger that is connected to another, more personal intervention that uses a BCSS that can be used in later stages of change. The topic for this design case was the lifestyle issue of drinking too many sugar containing beverages. For many people, their daily intake of sugar is too high which has a negative effect on their general health and wellbeing. Limiting the intake of sugar containing beverages can be a solution to this problem. Of course, we are not the first to address this lifestyle issue. There have been multiple attempts at creating environmental interventions to raise awareness of this issue (and thus addressing earlier stages of changes). These have often taken the form of posters or information boards that are placed in public environments such as schools or governmental buildings. Environmental interventions such as these may indeed raise awareness of the lifestyle issue. However, they do not support people in taking a next step in the behavior change process. Subsequently, in a small but promising study, Langrial & Oinas-Kukkonen (2012) have demonstrated that persuasive software using reminders may help people to reduce their intake of 'fizzy drinks'. However, the form of their intervention was especially suitable for people in the action phase. In fact, while recruiting respondents, these researchers specifically asked people if they were willing to reduce their intake of fizzy drinks. This study showed promising results but does not solve the problem of persuading people in earlier stages of change to decide to take the step to change. A sequential intervention (addressing multiple stages of change) could therefore be more effective in addressing this lifestyle issue.

Following the 'design for healthy behavior framework' three different products were designed for three different phases of behavioral change. The connected products that resulted from the design case were evaluated in a preliminary user study. Results from this study will be discussed.

3.1   Design and stages of change

The first product was designed to match the motivational state of people in early stages of behavior change. For this stage, two important issues have to be addressed. First, people in this stage do not want to change, and, therefore, they will not be willing to buy a product that supports a behavioral change. Second, the product should incorporate a design strategy aimed at *raising awareness*. During the idea generating phase, several ways of distributing information at low cost were explored such as stickers and (foldable) leaflets. Eventually, it was decided to choose a product that would be seen as a more valuable item (and that would therefore less easily be discarded). The product that was designed for this phase was a cooling sleeve that displays the amount of sugar that different types of beverages contain (see Figure 2). The cooling sleeve would be available as a free gift that could be handed out to people on the street. The print on the sleeve contains a QR code that connects to a mobile application that was designed to support a second phase of behavior change.

Fig. 2. Product designed for stages (pre)contemplation: a cooling sleeve with information about sugar in beverages.

To develop the product that should support the next stage of change, that of preparation, the designer of the intervention incorporated a design strategy aimed at *enabling*. To move through this stage people need to move from raised awareness to actually acting on a desired behavior change. During this phase, people have to come to realise that they should and that they are able to change their behavior. Therefore, it is important that an intervention can provide advice or possible actions that are relevant for a specific person to enable his or her to take action. In such a situation, a BCSS is a valuable solution because it allows organization of data and personalized feedback (cf. Oinas-Kukkonen & Harjuuma (2009)). To make the BCSS easily accessible, we chose to design a mobile application. The application supports people in tracking their daily intake of sugar containing beverages and gives them personal advice on how they can best change their daily habits, thus *enabling* them to take the next step towards the desired behavior change. Figure 3 and 4 show a sequence of screen shots that demonstrate the subsequent steps in the application; after adding some personal information, users provide information about the drinks that they drink for a week. During the week, they can gain view statistics to gain insight in precisely which beverages that they normally drink contain most sugar. After a week, the application creates personal advice and recommendations based on the provided data to support the user to take the step into an *action* phase. In this phase, people actually implement the behavior change based on the recommendations of the application.
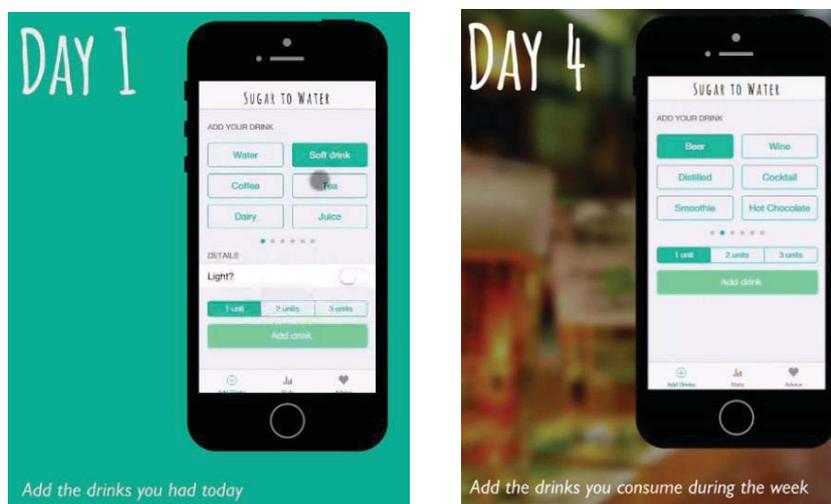
Fig. 3. The image on the left shows a screen shot of the mobile application on the first day where someone starts adding beverages from the menu to her daily intake. The image on the right shows a second screen in the same menu with different beverages.
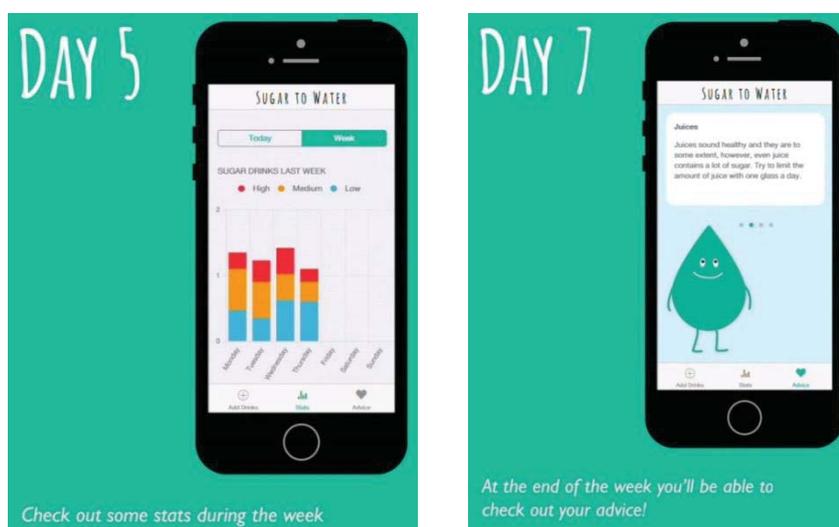
Fig. 4. Two more screenshots show the application after someone has added the daily intake of beverages for at least four days. The image on the left shows statistics that give a user insight into the types of drinks that have been consumed week. The screen shot on the right shows personal advice on how best to change behavior.

Finally, the system could recognize from the behavior pattern that the user is ready to take yet another step in the behavior change process: towards the stage of *maintenance* and recommends the product that that links to the third phase. The product that was designed for this third and last phase incorporated a design strategy aimed at *motivation.* The best alternative for drinking sugar containing beverages is drinking water. Therefore, a variety of alternatives was explored that motivate people to drink water, including light indicators and timers. Eventually, we chose a less intrusive solution because such a solution is less likely to cause irritation. The product for the designed for the third phase was a water bottle that supports the achieved behavior change by using an hour glass to remind the user to drink water (see Figure 5).

Fig. 5. Product designed for *maintenance* stage: incorporated design strategy aimed at motivation. The hour glass that is incorporated in this bottle reminds people to drink enough water.

3.2   Evaluative user study

To test whether the sequential intervention that was designed and that consisted of a set of connected products could be effective in supporting people to move through the different stages in a behavior change process we set up a preliminary user study. This user study had two main aims. The first aim was to find out if the first product in the sequence was effective for people in the early stages of behavior change and thus, if it was effective in creating awareness of the lifestyle issue of drinking too many sugar containing beverages. The second aim was to test whether the first product in the sequential intervention was effective as a trigger to connect to products in later stages of change.

Method.
The first product in the designed sequence, the cool sleeve was handed out to 18 respondents (age 25-60, m = 34.3, 9 female). Respondents were randomly selected but we tried to find respondents from multiple age groups and we tried to invite both men and women. Because the second product in the sequence, the personal application was not yet available we created a movie explaining the application and placed it on a website. Attached to the cool sleeve was a card that had a text, a URL linking to the movie and a QR code linking to the URL printed on it. The text on this card read: "KNOW YOUR BEVERAGES. Are you curious to find what you sugar intake through beverages is? Scan the QR code or visit the URL." After three days, the participants were asked to fill out a questionnaire asking questions about how they evaluated receiving the cool sleeve *("I liked receiving the sleeve")*, whether they had noticed the information on the cool sleeve and whether this information had raised their awareness of the amount of sugar in beverages *("The information on the sleeve made me more aware of sugar in drinks")*. We also asked whether they had visited the website to see the movie and (if yes,) whether the video made them think of the amount of sugar they consume through beverages and whether they would be interested in using the application that was presented in the movie. Questions were either yes/no questions or were asked on 7 point scales with end points "do not agree at all" and "agree completely". At the end of the questionnaire participants were asked to provide additional comments.

Results.
Receiving a gift like this was something positive for almost all respondents, only two people noted that they weren't certain about if they would ever use the sleeve. Responses to the question that asked whether they had seen the information on the sleeve were clearly positive (m = 6.3). Also, respondents noted that the information on the sleeve made them more aware of the amount of sugar in beverages (m = 5.3). General remarks revealed that in general respondents became more aware of sugar in drinks after reading the information on the sleeve. Some of the participants noted the fact that they already mostly drank water, tea and other drinks without sugar. However, the large amount of sugar in some beverages seemed to surprise all of them.
Out of the 18 participants, 15 eventually visited the linked web page and watched the video about the personal mobile application. Participants generally responded positively to the question about whether the video made them think about the amount of sugar they consume through beverages (n = 15, m = 5.0). Also, participants indicated that they were interested in the free application that would allow them to track the amount of sugar they consume through drinking beverages (n = 15, m = 6.6).

Discussion.
First of all, the free cool sleeve that we handed out in this preliminary user study clearly was effective in raising awareness of the lifestyle issue of drinking sugar containing beverages. People were pleased to receive the sleeve and they all noticed the information on the sleeve. The fact that all respondents took notice of the information is a very positive result: it may be easy to hand out free gifts, but raising awareness

through such a free gift is another step. Our results show that for almost all respondents their awareness of sugar in beverages was raised. Out of the 18 participants, 15 eventually watched the video, which indicated that they became interested in the subject of sugar in beverages. Again, most of the participants noted that the video in its turn raised their awareness of the issue. Moreover, the larger part of our participants, expressed their interest to actually use the application, thereby indicating that they were ready to move to the next stage of change.

The mere fact that the people in this study were part of a trial might have biased their expression of interest. However, the large group of participants that were interested in the application signals that the free cool sleeve worked well as a trigger to increase reach for this BCSS. As yet, we were unable to test the effectiveness of the application in this study. A more extensive study with a working application should be done to test whether this application is an effective intervention to support people to actually change their behavior.

4   General discussion

We have argued that to increase the large potential of BCSS to help people to adopt healthier lifestyles, the reach of such systems should be enlarged so that the people that need them most (those who are in early stages of change and are not yet aware of the need for change) will start using them.

The design case showed that placing triggers in the environment offers possibilities to connect BCSS to the offline world. In this case, the trigger was a free gift that people would receive in a public environment. Although this was not a valuable product, non-personal triggers may provide solutions that are less costly and can therefore reach even more people. For such non-personal triggers, a clear and easy to follow link to a following, more personal intervention is essential.

The case we presented here was about drinking less sugar containing beverages, however, triggering a behavior change and connecting to BCSS could be effective for a range of other behaviors that are widespread. One could think of behaviors such as eating too little fruit and vegetables, unhealthy snacking, etc. What this specific design case has shown is that analyzing the context of the intervention is important; what are people's habits concerning a specific lifestyle issue? What would be the best place to try to persuade people to try an alternative or to raise awareness of the issue? We expect that by asking these questions and adding triggers in the environment to the design of BCSS their reach could be enlarged to include people in early stages of change. Note that in the design case presented, next to the trigger and the BCSS, a third product was added aimed at helping to sustain the new behavior. Alternatively, for this stage of change (maintenance), a BCSS could be adapted to meet the goals for this stage. Such 'dynamic interventions' form an interesting research avenue and could potentially increase the effectiveness of BCSS to a large extent.

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