
Understanding Users' Creation of Behavior Change Plans with Theory-Based Support

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Abstract

The goal of this project is to develop tools that support users' creation of their own behavior-change plans. We conducted two formative user studies to explore people's creation of plans for their own behavioral goals. Users were provided with minimal support to facilitate goal-setting, use of behavior-change techniques, and self-monitoring. In this paper, we present insights on how to further facilitate personalization of behavior-change plans.

Author Keywords

Behavior change; Goal-setting; Behavioral plans

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

Support for people's behavior change is a popular topic in human-computer interaction (HCI) [e.g., 6]. Digital technologies have the potential to help people achieve personal goals like exercising or working more efficiently. The majority of behavior-change technologies emphasize pre-determined strategies for fostering behavior change, chosen by the designer (see

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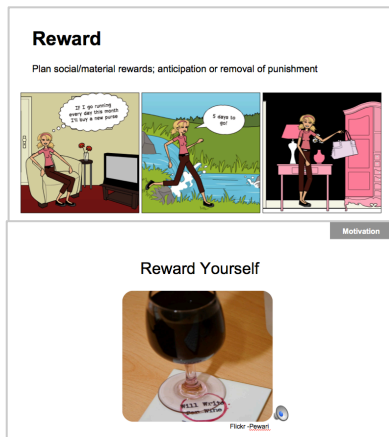


Figure 1. In Study 1, the concept of each technique was delivered with a short sentence of its key idea and an example depicted in storyboard-format (top); in Study 2, we provided more informative, recorded narratives for key ideas and examples, with suggestive pictures (bottom).

related work). It is likely that individuals will have idiosyncratic needs that cannot be anticipated via pre-fabricated solutions. This problem will likely only become more pronounced as behavior-change technologies are more ubiquitous and individuals use them for months or years rather than days or weeks.

We are exploring an alternative strategy. The long-term goal is to develop a do-it-yourself self-experimentation toolkit that includes a “design support tool” focused on teaching fundamentals in creating personalized behavior-change plans [9] and an end-user programmable behavior-change technology that can be used to facilitate the plans individuals develop [5, 9]. The purpose of this paper is to describe formative work in developing the design support tool. We conducted two user studies to better understand common pitfalls users experience while creating behavior-change plans, and develop a tool that can address those pitfalls.

Related Work

As the trend progresses towards technology-enriched environments, researchers have been increasingly exploring the use of technology to promote behavior change for topics like health or energy conservation [2, 4], often drawing on behavioral theories [6]. For example, King et al. [7] previously developed three smartphone apps focused on improving mid-life and older adult’s physical activity. The apps included a more game-like app focused on increasing someone’s positive emotions for activity, a socially-oriented app focused on increasing a person’s awareness of the activity of others, and a rationally-driven app focused on helping individuals set goals and track progress. Results from this work indicated success at increasing physical activity with each but also found preferences

among the users that shifted over time. Many individuals requested a “mix-and-match” approach at different times. While these pre-specified tools were useful, formative interviews reinforced the need for strategies to facilitate personalization over time.

Contrasted with these pre-specified plans, the Quantified Self movement [1] reflects the sort of activities we wish to facilitate but with a broader segment beyond current Quantified Selfers. Understanding how best to support this sort of self-experimentation is still in its infancy [1].

Initial Design Support Tool

One fundamental part of our approach in helping users’ behavior change is to teach them about behavior-change techniques so that they can apply them in their own lives. Behavior-change techniques are “observable, replicable, and irreducible component[s] of a [behavioral] intervention designed to alter or regulate behavior; that is, a technique is proposed to be an ‘active ingredient’ (e.g., feedback, self-monitoring, and reinforcement) [11].” We chose three generic features of a behavior-change plan to establish a generic structure: (1) goal-setting, (2) other techniques that can support meeting a goal (e.g., strategies such as self-rewarding), and (3) self-monitoring to determine success and facilitate iteration. We chose goal-setting and self-monitoring as two required techniques and then provided other behavior-change techniques that cover categories identified in Michie’s behavior-change taxonomy [11] (e.g., self-reward, prompting to action, seeking social support). The tool guides users to generate actionable goals, create plans applying a variety of behavior change techniques, and do self-tracking to help observation.

¹Fogg's model proposes 'Motivation, Ability, and Triggers', while Michie et al's COM-B model emphasized Capability, Opportunity, and Motivation. We collapsed Ability and Capability, as they are similar constructs. We considered Triggers and Opportunity to be related but distinct.

² **Trigger:** Define a trigger; Information or inspiration as triggers; Counteracting negative emotional triggers

Opportunity: Find the opportune/dangerous time and place; Turn off your "auto-pilot"; Make it the "default" option

Ability: Script critical actions; Shrink the change; Build habit chains

Motivation: Define your inspiration; Ride the wave; Reward yourself.

Study 1

This study was described previously [9] and thus only briefly described here. We developed a low-fidelity prototype of the design support tool and conducted a user study. Participants were a convenience sample (N=11, 9 females and 2 males, ages from 18-39) of college/graduate students at a large US university. Participants came in for three sessions over two weeks. By design, the sessions were delivered by individuals with no formal clinical training to ensure training did not contribute to potential effects of the session design.

In the first session, we supported goal-setting by asking individuals to think about a "New Year's Resolution" that they wanted to work on. They were then asked to think of smaller sub-goals to make the behavior more manageable. After the goal was selected, we asked individuals to generate a plan to reach their goal, and then prompted them to critically examine this plan by reflecting on past experience with this problem. Participants were then provided 13 other techniques to incorporate into their plan and asked to choose 3. The researcher then presented two options for self-tracking: structured or unstructured. Structured journaling involved creating quantitative questions (e.g., how stressed are you on a 1-5 scale?) whereas unstructured was a free-flow of thoughts and ideas. In both types, participants chose specific times of day to self-track. In the two subsequent sessions, participants went through a similar procedure, but focused on revising their present plans or, if they wanted, creating new plans. Week two and three also included a brief interview on their experience the previous week.

We found two issues. First, participant-generated goals and plans were too vague to be actionable. Second, our

strategy for incorporating evidence-based techniques did not work. Counter to expectations, providing the techniques did not enrich their plan but instead provided participants with an often false label for the plan they had already decided upon. While participants changed at least one behavior-change technique between sessions, very few tweaked the first technique. In later sessions, participants reported 'burning out.' This suggested they may not have been self-diagnosing the true problems for achieving the goal. In particular, most emphasized motivation and did not think much about other factors. This insight led us to provide a behavior-change framework to support self-diagnosis.

Revised Design Support Tool

Based on these findings, we created a revised prototype. To facilitate actionable goals, we adopted an evidence-based goal-setting strategy, the SMART (Specific, Measurable, Actionable, Realistic, and Timely) goal concept [8], which is a reinterpretation of Locke and Latham's goal setting theory [10]. According to the SMART concept, goals that meet each of the acronym's words (e.g., specific, measurable, actionable) will result in more effective goals. To support self-diagnosis, we categorized techniques via meta-models of behavior that, like our generic plan, could be used across a wide range of behaviors. We leveraged two existing meta-models, Fogg's behavior model [3], and Michie's COM-B model [12], which were developed to help professionals create interventions. We organized techniques into four domains¹: Opportunity (availability to engage in a behavior), Triggers (prompts to perform the behavior), Ability (having the required skills/attributes to perform the behavior), and Motivation (drive to do the behavior). Existing behavior-change techniques were labeled with each domain.²



P6's plan

(Session 1)
SMART goal: Spend at least 1 hour per day (5 days per week) writing dissertation
 Plan to apply the techniques: Write at home at desk. Dayn send reminder text or verbal every day. Post-it-note on bathroom mirror. Timer. No looking at other stuff during writing time (Facebook, email, etc.)

(Session 2)
SMART goal:
 Spend at least 1 hour per day (5 days per week) in the morning at home working on dissertation. If there is an unusual event and I cannot complete my goal then I can have a make up day on the weekend.
 Plan to apply the techniques: Script Critical Actions: Wake up, alarm clock in room and one outside of room to make sure I get out of bed. Then shower and make breakfast. Look at email while eating breakfast and set time to start working. When time comes close all other things (facebook, email, news, etc.) and start. Remember you want to graduate!

Study 2

Method

Participants were a convenience sample (N=7; 5 female and 2 male; with one dropout) of graduate students at a large US university. Similar to study 1, they were asked to participate in three sessions focused on creating behavior-change plans.

In Session 1, participants chose an issue they would like to work on and to choose a 'behavioral goal.' Then, we taught the SMART goal concept and asked participants to create a SMART goal. Participants were taught one technique from each of the domains and then asked to generate a plan on how they would use each technique. For each behavior-change technique, we provided a recorded narrative (30-40sec) describing the technique, including an example. Participants were given a chance to either incorporate or ignore each technique. In session two & three, participants reflected on the quality of their SMART goal and revised as necessary. In session two, they were taught the framework and informed that the four techniques taught in session one were examples of each domain. Participants were asked to self-diagnose the most problematic domain for them (i.e., is this a trigger, opportunity, motivation, or ability problem?) and then presented two more techniques for the problem domain. Participants were presented the same options for self-tracking as Study 1.

In this study we used both qualitative and quantitative strategies to understand how individuals develop behavior-change plans. We used a survey to examine session experience, and conducted a semi-structured interview after each session to glean insights about the process. To analyze the data, the lead author listened

to all recordings (both of the interviews and the sessions) and documented themes that arose.

Results

Compared with Study 1, goals the participants set were more specific (e.g., 'Study every night' vs. 'Spend at least 1 hour per day, 5 days per week'), and the participants reported appreciating the SMART goal. However, the goals and plans were still not as specific/actionable as the SMART concept would prescribe. For instance, many individuals (57%, n=4) found that they were unsure how best to set both a specific AND realistic goal. For example, P3 often had guests or dinner appointments with friends. Based on this, she said that she would write during the day but not set a specific time.

Participants appeared to demonstrate better use of the behavior-change techniques compared to Study 1. Unlike Study 1, participants reported liking and actively using the behavior-change techniques when creating their plans (e.g., P5, 'It's good to have all of them at once'). However, most participants did not understand how to develop a good trigger (71.5%. n=5) or script a critical action (71.5%. n=5) during session one. Many participants set triggering times that were not at the time when they would engage in the activity (a requirement for a good trigger). P4, for example, set a notification on her mobile phone at 12p to remind her to work at 2p. These small details were not grasped at first but did start to be understood after one week of experience. We also found that the example given for a technique greatly impacted how creative most individuals were in personalization. Specifically, most participants used the triggering example (i.e., notification from the phone) as the only type of trigger.

While this may be fine, it is plausible that they did not personalize it enough to make the technique useful for themselves. For example, P2's "trigger" to be more empathic was the pressure he felt from his ring when he shook hands. This was a creative personalization that was not common, but potentially very valuable.

Compared to study 1, there also appear to be improved understanding on how to iterate on the concepts (which was supported by better self-reported success in achieving the goals in study 2 compared to 1). This seemed strongly influenced by the person's personal experience using the plans. Unlike study 1, plans almost always (86%, n=6) became more elaborate and personalized to the person's daily life. For instance, P7 set her target time to go to bed differently for weekdays and weekends, which was not differentiated initially, based on her failure the previous weekend. P4 originally set a goal of "work for 2 hours" but during session two changed it to a more actionable goal of "practice speaking through presentation twice per day." Participants also presented more vivid descriptions on how they carried out their plans. For instance, while initially P6 was going to work "in the morning," it was changed into "after having breakfast, and checking emails and news." Active use of the techniques also appeared to help them better diagnose the domain to work on (86%, n=6). For instance, P4 chose 'Ability' as her problematic domain in session two. Upon further reflection though, she realized it was a motivational problem as she prioritized friends over work.

Lastly, most participants (71%, n=5) demonstrated far better understanding of the different techniques after trying them out. For example, many participants did not understand the idea of scripting critical actions

during session one but after trying it out, found it to be an essential and important technique. P6 found that there were a couple of routines she did before starting her work and carrying these routines out swiftly led her to successfully start working on her target activity.

DISCUSSION AND CONCLUSIONS

Overall, results indicate that our convenience sample could develop and refine their behavior-change plans and it appears that plans were better refined in our second user study. Of particular importance, our findings suggest that the addition of a SMART goal and including a meta-model to help understand behavior-change techniques did enable individuals to more rapidly self-diagnose and improve upon their behavior-change plans. This iterative improvement did not occur during Study 1, and thus is an important finding. While we did see self-reported improvements, we still found some problems persisting related to supporting the development of personalized plans. Specifically, we still found the continued influence of the examples given on establishing the perceived range of available options for a given technique. That said, we did find that using the meta-model appeared to improve creativity.

A core future direction for our research is to better understand how to further facilitate the creative personalization of the techniques. It was clear that participants' experiences with the techniques improved customization. However, we also found participants' ideation was often constrained by the examples we provided for each technique. We believe that more research on facilitating increased creativity and the techniques will be important for aiding individuals in coming up with effective, personalized plans. Based on the positive effects that experience had during the two-

week study, it is plausible that simply giving individuals enough time (i.e., more than two weeks) to engage with self-diagnosis and implementation of their plan might be enough but this requires empirical validation. Providing more examples, particularly extreme examples of a technique, is another strategy we plan to expand upon to facilitate personalization.

Our study had several limitations. This was a convenience sample of educated individuals, thus generalizability is limited. Further, a majority of the sample chose issues related to work (e.g., P3, 'write a manuscript') and thus we did not study some important behaviors (e.g., smoking cessation). Another limitation is that the study lasted two weeks. Finally, researcher's presence in sessions and involvement in delivering materials may have biased the individuals' ideation.

As an initial effort in developing tools that support users' creation of their own behavior-change plans, we conducted a two formative user studies. Overall, we found that the improvements we implemented between our first support tools and second did appear to facilitate iterative improvement between the sessions.

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