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# From Intentions to Successful Action: Supporting the Creation and Realization of Implementation Intentions

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**Abstract**

"Good" intentions, such as to exercise more, only rarely spur action. In contrast, so-called "implementation intentions" explicitly relate goal-directed behavior to particular situations (e.g., when, where, and how). Studies show that this has a positive effect on goal achievement. This paper explores whether technology can support the transformation of "good" intentions into concrete implementation intentions and their triggering as well as routinization. Specifically, we report three single case studies with a functional prototype. This prototype supported creating implementation intentions, putting them into a calendar, and being reminded through an object representative for the planned activity. Through the prototype, all three participants engaged more in the activities chosen to fulfill the intention. All in all, the notion of supporting individual implementation intentions through technology seems a viable strategy to support behavior change.

**Author Keywords**

Persuasive Technologies; behavioral change; motivation; exercising; Implementation Intentions.

**CSS Concepts**

• **Human-centered computing**~Interaction  
Design~Empirical studies in interaction design



Figure 1: Reminder object placed next to skipping rope to exercise.

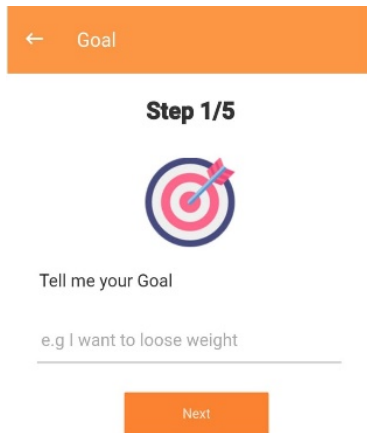


Figure 2: Application (Step 1)

## Introduction

Getting sufficient physical exercise in everyday life is challenging. Among the crucial barriers to healthier living is a lack of motivation. While people often intend to exercise, they never seem to get around to do it.

There is a wide variety of theoretical approaches to better understand motivation and volition. In this paper, we explore the notion of "implementation intentions" [5]. While regular "good" intentions remain abstract ("I intend to exercise more") and only rarely spur action, implementation intentions explicitly relate specific goal-directed behavior to particular situation (e.g., when, where, and how). Thus, implementation intentions can be expressed as "if-then" relations – Gollwitzer [5] calls them "simple plans". The idea of simple plans is to create a certain automaticity, i.e., the situation triggers relevant behavior. It circumvents it with more direct action ("Monday afternoon, running afternoon"). Studies show that this has a positive effect on goal achievement [13,14].

Although many studies in HCI focus on behavior change [1,2,10], only a few technological or interaction design concepts exist, which make explicit use of implementation intentions and their psychological benefits (e.g., their potential independence of self-control resources). One example are Laschke and Hassenzahl's "pleasurable troublemakers", which materialize "simple plans" to foster behavioral change (e.g., [6,7]). Another example is a "digital wellbeing" app based on Öttingen's WOOP model [12] (Wish, Outcome, Obstacle, and Plan). The app helps to set goals and to transform them into an implementation intention. However, there are neither reminders nor further tracking information available. In fact, adding reminders to implementation intentions,

that is, augmenting the trigger, has a further positive effect on behavior change [15]. Further studies generally hint at the possibility that implementation intentions *per se* may not be sufficient without the use of external technological aids, such as reminders [3,4,16]. However, it remains unclear how reminders or triggers are formed and experienced to support embedding simple plans into everyday life.

This paper further explores whether technology can support the transformation of "good" intentions into implementation intentions and their triggering as well as routinization. Specifically, we report three single, case studies with a functional prototype. There-by we want to contribute an initial study that shows the potential to support the creation and realization of implementation intentions through technology.

## A Functional Prototype

The functional prototype consisted of a smartphone application combined with Google Calendar's "Goal" feature and a physical "reminder" (figure 1). The application featured a tutorial to support the participants with transforming their intention (e.g., "to become fit") into an implementation intention by specifying the what, how, where, and when (figure 2 & 3). The goals feature was used to set a time at which the participant would like to perform the activity. This feature automatically created a schedule for activities based on the frequency and time preference of each participant. The reminder housed a motion sensor, light, and a phone (figure 1). Using IFTTT [4], applets were designed to play a customized tune when events in the calendar were about to begin. At the set time, the tool played a short message followed by a song via the phone within the reminder housing. The motion sensor triggered the light

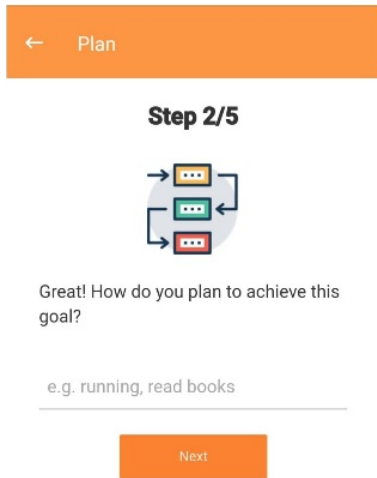


Figure 3: Application (Step 2)

whenever somebody passed the object. The main conceptual idea of the reminder was to place it close to an object important to the activity (e.g., running shoes) in plain sight. Thus, when the time for the activity had come, the activity-oriented object itself became the reminder. In addition, casual passing highlighted the reminder object, presumably bringing the activity and the related intention back to mind.

**Method**

The study consists of three separate single participant cases. The first case was autoethnographic (e.g., [8,11]), run by the first author. The remaining cases were conducted by the first author with external participants. Participants were acquaintances of the first author who had no prior knowledge of the study. All three participants stated the intention to exercise but found respective behavior challenging to implement. Table 1 summarizes the participants. For the sake of brevity and comparability, we treat all cases similarly, despite case 1 being autoethnographic. All cases followed the same procedure.

Each case consisted of two phases (baseline, intervention), which lasted one week each (i.e., two weeks altogether). For the baseline phase, participants were instructed to go about their activities as they would on any regular day. In the evening of each day, we sent a text message and asked how the day overall had been and whether participants engaged in activities related to their intention. We closed this phase with a short interview to summarize the previous week, as well as whether they had been successful in achieving their goal and potential reasons behind failure or success.

We then introduced the prototype and started the intervention phase. Participants were asked to follow the instructions provided by the application. After stating intentions, specifying a goal, and identifying an appropriate activity, they placed the prototype next to an object they use in the activity. We further requested to make sure that the reminder and object were placed somewhere visible. Finally, we provided them with an email ID. They were then required to set the time using the goal feature in Google calendar. As participants were curious to learn what would happen, they were informed that the prototype would remind them at the set time without giving any further information.

The remainder of the second phase (intervention) was then carried out similarly to the first phase. At the end of the week, we conducted a final interview to summarize the week, to learn about their behavior towards the prototype, and how successful were they in achieving their goals. Recordings were transcribed and analyzed.

Approximately two weeks after completing the intervention phase, we contacted the two participants and informally asked them whether they had been successful in keeping-up the intention-related activities.

	Sex / Age	Occupation	Intention (Goal)	Activity
P1	m / 26	Student	Fitness	Run
P2	m / 30	Physician	Weight loss	Gym
P3	m / 25	Student	Weight loss	Exercise

**Table 1:** Participants

**Results**

In the following we present our results of the three individual case studies. Note, for the autoethnographic

case (case 1) we switch into a first-person narrative provided by the first author.

*Case 1 (autoethnographic, P1)*

My goal was to become fit and hence I decided to go running at least twice a week. It was an activity that I kept procrastinating. While the baseline week was emotionally a "good" week (table 2), I could not find the energy to run. There were moments, when I thought of going for a run, but laziness and bad weather got the better of me. It had been a week of excuses.

I then began using the prototype. I set up two simple plans: I set the goal intention to become more fit and chose running as an activity to achieve this goal. After confirming the suggested dates in Google calendar, I positioned the reminder next to my sneakers. My attention was constantly drawn to the light-triggered whenever I passed the shoes. Through this, the thought of running kept recurring. This helped to build the energy when the time came actually to run. When the reminder went off the first time, I immediately looked at the shoes, got up, and went for a run. It felt as if I was already waiting for it. The second time, I was napping when the reminder went off. I looked at the shoes and the reminder. I set the reminder to snooze. After half an hour, it rang again, and I went for a run. Overall, it felt like as if the shoe was constantly reminded me to "use" it. I went for two run as intended. Although the current week was more or less similar to the previous week, having gone for a run made me feel fit, which impacted my overall mood.

*Case 2 (P2)*

The second participant chose the activity of going to the gym. Even though he does not visit the gym, he

finds it important: "[...] Because its fitness man, look at me, I'm a potato. That's why I find it between very important and more than important." During the first phase (see table 3), his week was rather tiring: "Because of work, I have been coming home late mostly." However, he managed to go to the gym once. He claimed that the visit to the gym was in part self-motivated and in part a consequence of the daily questions regarding the day: "You have been asking me daily! And I wanted to go. You know psychologically that [daily prompt] already played a role at the back of my head." This fits his regulatory state as "introjected" [9]. He said that most of the times, when he thinks about the gym, he is either too tired or too lazy. "[...] the one or two days [...] I have where I come home on time, I end up cleaning or cooking. But that's a shitty reason, I am more or less just lazy."

On introducing the system, the participant chose to place the prototype next to his gym bag as his goal was to lose weight. He completed his going to the gym three times as intended (table 3). When he missed the activity on one of the scheduled days, he rescheduled the activity for the next day by setting the time in the calendar. He described the week to be good at the start. When he missed the activity on one of the scheduled day, He rescheduled the activity for the next day by setting the time in the calendar. Obviously, good days coincide with visits to the gym. To him the motivational factors were partly because of the prototype, partly self-motivation and partly because of a friend accompanying him. "With the reminder, right, because like normally I don't set any alarms to go the gym but because I set an alarm to go to the gym, I was forcing myself to get up and go." He found the reminder to have impact because of its ubiquity: "[...] not just the

Baseline	Activity	Mood
Mon	-	Okay
Tue	-	Okay
Wed	-	Tiring
Thurs	-	Tiring
Fri	-	Good
Sat	-	Okay
Sun	-	Good

Intervention	Activity	Mood
Mon	-	Okay
<u>Tue</u>	+	Good
Wed	-	Good
<u>Thurs</u>	+	Tiring
Fri	-	Good
Sat	-	Good
Sun	-	Good

**Table 2:** Summary of week 1 and 2 (P1). Days on which an activity was scheduled are underlined.

'+' represents activity completed.

'x' represents activity missed.

fact that it was next to the gym bag, but also like you're sitting on the couch being lazy and you can see the light go off telling you to go to the gym." The participant found having a pre-defined schedule convenient, but not remembering the exact time was a concern: "[...] like the first time I knew it was going to go off so I stayed home but after that I didn't know when it was going to go off, like I knew but I kind of forgot with work and stuff and everything [...] that day (Wednesday) if I had probably decided to go and do grocery shopping and the alarm went off I would have probably not gone [to the gym]." When asked about the impact of the system in planning his schedule, he explained that on the third day he failed to go to the gym, "one time I was scheduled to meet with friends, so that alarm went off, (I) think the same time I had to meet with them, and they had reminded me about that, that evening so I was like I can't go anymore (to the gym). But there I didn't change my schedule to go to the gym, but I changed the gym schedule to the next day."

**Case 3 (P3)**  
 The third participant wanted to exercise daily. "It's not like I can't achieve it, but I don't find the motivation and there are certain factors like weather, or the floor being dirty [...]" and, "I find exercising extremely important [...] I am in my mid-twenties and that is the age where you really need to get into shape because that is going to decide whether you are going to last in your late 50s [...] I don't find exercising to be fun, because it's hard for the body." This is also typical for being "introjected" [9]. During the baseline phase, he did not exercise at all. One of the major reasons he identified the lack of sleep, which made it impossible to wake up and perform exercises at the desired time. Another reason he claimed was laziness.

During the second phase, he managed to exercise 6 days as he intended. "It was happening. I was doing exercise so it was good. Last couple of days it was awesome, it's been a good week" (table 4). For him, self-motivation and prototype were the factors that helped him to go the gym. "[...] I was not actually doing the exercises before. But now I knew that something in my room is there, it's creeping into my thoughts, because it is related to exercise, so it kept on reminding me yes you have the motivation, now take the action." However, as he chose to exercise daily, the prototype had an impact mostly during the initial days, "First couple of days it got me reminding I have to do exercise. Later it got in my routine that you're getting into exercise." In fact, this is what implementation intentions aim for: turning an activity into a routine.

**Informal follow-up**  
 After two weeks we conducted an informal follow-up session where we asked participants if they were successful in performing their desired activities without the prototype. Both P2 and P3 failed to continue performing the intention-related activities without the support of the prototype. Upon request, they could not provide any plausible and strong explanation.

**Discussion**  
 All three participants engaged more in the activities chosen to fulfill their intended goal in the intervention phase (with the prototype) compared to the baseline phase. Thus, it seems fair to assume that the prototype, in the sense of the overall technological arrangement we provided, played at least some role in engaging participants in intention-related activities.

Finally, it remains unclear which part of the prototype

Baseline	Activity	Mood
Mon	-	Tiring
Tue	-	Tiring
Wed	-	Okay
Thurs	-	Good
Fri	+	Good
Sat	-	Good
Sun	-	Okay

Inter-vention	Activity	Mood
<u>Mon</u>	+	Good
Tue	-	Tiring
<u>Wed</u>	+	Good
Thurs	-	Tiring
<u>Fri</u>	x	Good
<u>Sat</u>	+	Good
Sun	-	Tiring

**Table 3:** Summary of week 1 and 2 (P2). Days on which an activity was scheduled are underlined. '+' represents activity completed. 'x' represents activity missed.

Baseline	Activity	Mood
Mon	-	Okay
Tue	-	Okay
Wed	-	Tiring
Thurs	-	Okay
Fri	-	Okay
Sat	-	Okay
Sun	-	Good

Inter- vention	Activity	Mood
<u>Mon</u>	+	Good
<u>Tue</u>	+	Tiring
<u>Wed</u>	+	Good
<u>Thurs</u>	+	Tiring
<u>Fri</u>	+	Tiring
<u>Sat</u>	+	Good
Sun	-	Good

**Table 4:** Summary of week 1 and 2 (P3). Days on which an activity was scheduled are underlined.

'+' represents activity completed.

'x' represents activity missed.

carried the effect – transforming intentions into situated activities, putting those into a calendar, or being reminded through objects representative for these activities. In fact, each participant found different aspects more engaging than others. For P2 the light and alarm reminded him to go to the gym while for P3 it was the interaction of completing the activity in the calendar that kept him engaged. Future studies need to unpack further the elements crucial for supporting the creating and realization of implementation intentions through technology.

An element mentioned by each participant, was placing the reminder next to an object related to the activity to be performed. As intended, this had a direct as well as an indirect effect. It created a time-related external trigger, which directly supported the initiation of the activity. In addition, it became an indirect, constant reminder of the activity itself. P2 identified that having placed the reminder and his gym bag in front of his couch made a greater impact as he was constantly drawn to it. He was uncertain whether his regular position, i.e. the corridor would have had the same effect. The reminder draws particular attention to the activity (through technical functions and mere non-technical presence) and has, thus, a valuable double role. In future work, we will attempt to further blend the actual reminder technology and the object crucial for the activity (e.g., gym bag). So far, participants' perceived reminder and object as two entities. However, we believe the reminder to be even more meaningful and long-lasting, if we create the impression that the object *per se* reminds – just imagine a gym bag, which does not remain neutral, but "wants" to be used, thereby drawing attention to intentions, goals and activities.

## Conclusion

Implementation intentions help people to put intentions into action to achieve goals such as sufficient physical exercise. Technology can support people to make use of the concept of implementation intention. We presented findings on three individual participants who used a functional prototype that supports the transformation from "good" intentions into implementation intentions, their triggering, and routinization. In sum, by using the prototype, all three participants formed an individual implementation intention and engaged more in their chosen activities. After removing the prototype, all participants returned to their previous behavior.

The present design-oriented study is limited in sample size and duration. While we believe that these types of naturalistic study set-ups are of high value, in its current form, we can neither uncover long-term effects nor can safely generalize further. It remains unclear whether the prototype would prolong its positive effects in longer intervention phases. Furthermore, we do not know yet, whether the prototype would be pivotal in transforming the activity into a routine, maybe even making the technological support itself obsolete. The informal follow-up showed at least that the activity is not kept-up without the prototype. This finding hints at the potentially positive role the prototype played in the intervention phase. Finally, the notion of supporting the creation and realization of individual implementation intentions seems to be a viable strategy to support behavior change. In the present case, participants engaged more in health-related beneficial activities given our technological arrangement had supported them. Additionally, this made them feel better – presumably due to the refreshing effect of exercising and the warm glow provided by fulfilled intentions.

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