Virtual Challenges: A Social Interaction Approach to Increasing Physical Activity

André Fialho[1], Herjan van den Heuvel[1], Qonita Shahab[1], Qing Liu[1], Li Li[1],
Privender Saini[2], Joyca Lacroix[2], Panos Markopoulos[3]
[1]User System Interaction, Stan Ackermans Institute, TU/e
[2]Philips Research Eindhoven, [3]Industrial Design, TU/e
{a.t.s.fialho, h.a.c.v.d.heuvel, l.li, q.liu, q.shahab}@tue.nl,
{privender.saini, joyca.lacroix}@philips.com
p.markopoulos@tue.nl

Introduction

Several studies indicate a growing increase in the number of people that are overweight. Along with psychological stigmas, these people have increased risk for heart diseases, high blood pressure, diabetes, arthritis-related disabilities, and some cancers [1]. Sedentary lifestyles and consumption of energy dense foods are the main factors leading to these conditions. A change in lifestyle through an increase of physical activity is commonly known to aid combating obesity. Additionally, regular physical activities reduce risks and provide therapeutic benefits for people that suffer from several health conditions.

Motivating an increase in physical activity is a known challenge, as there are several barriers that prevent people from having a healthier lifestyle. The use of persuasive technology has been proven effective in many cases. In the past, most studies relied on self-monitoring, by using, for example, diaries to asses people's physical activity level [2]. More recently, however, devices such as pedometers are used to unobtrusively measure physical activity [3]. In addition, we see that motivational strategies from psychology are employed, to increase persuasiveness of the intervention. In this area, a well-known approach is that of goal setting. These goals are usually determined by a system, and can be altered by the users themselves [4]. Goals can be individual or collaborative, in which each user must fulfill part of the goal. According to Weldon and Weingart [5], group goals motivate users to improve the personal performance, because they recognize that group success depends on the performance of the individual users, and because users tend to work together more effectively.

As group goals imply, persuasive systems can be built on top of social networks, so users can interact with each other. This allows for the benefits provided by social dynamics [6]. For our approach, we propose ActivityShare; a service application that combines selfawareness with social goal setting. We provide self-awareness to the user by unobtrusively measuring physical activity through a small accelerometer device, which measures movements in three dimensions. This device is the Philips Activity Monitor, which converts all movements into calorie expenditure. In line with the currently growing trend of sharing digital information, we propose a novel approach to goal setting: social goal setting. We enable users to share goals by proposing activity challenges to others. These challenges are posed to all users, and everyone is free to accept/ignore the challenges. Once accepted, the challenge becomes a new goal to achieve.

Initial Requirements

We performed an extensive literature survey on physical activity and persuasive technology. This led to an overview of existing technologies and solutions, pointing out their benefits and drawbacks. The overview inspired a rough concept. We employed a user-centered design approach to come to a final design. The design approach consisted of several iterations; we involved end-users in each iteration.

After the initial concept, we started with interviewing sedentary people about their current lifestyle and about their thoughts on our initial concept. The results of the interview led to a further specification of the concept. This concept was prototyped and put to the test in a real user environment. The results inspired a next iteration of the concept. At this point, we created a video prototype. This prototype was extensively discussed in a focus group. The results of the focus group were used to define the fully functional prototype, which we intend to use in a final user test. Below we describe each design iteration in detail. We report the method as well as a summary of the findings.

Initial Interviews

Initial interviews were conducted in order to make a first step towards people with sedentary lifestyles. The interviews addressed their opinions about their physical activities and our initial concept. All participants (n=6, 2 females) were students who considered themselves to have sedentary lifestyles. Questions addressed their current lifestyle and habits, opinions on activity monitoring, activity sharing within a social group, and about the possibility of sharing challenges.

Most interviewees understood the importance of a healthier lifestyle and were interested in making positive changes. They liked activity monitoring, and preferred to see progress through real data such as body weight and blood pressure. Most of them preferred an expert or a friend to motivate them, instead ofstrangers. They suggested a system that would be linked to their schedule, so it could remind them to do activities whenever there was an empty time slot. On the topic of sharing, they reported that they had no reservations about sharing information with close friends. On the topic of feedback, they indicated that they would prefer positive encouraging feedback rather than negative.

These results reflected an agreement towards our initial design concept, further specifying features like the presence of an expert and the preference of interacting with closer friends rather than strangers.

In: Wouters, I.H.C.; Tieben, R; Kimman, F.P.F.; Offermans, S.A.M. and Nagtzaam, H.A.H. (Eds.)
'Flirting with the Future', Proceedings of SIDeR '09, April 15-17 2009, Eindhoven University of Technology, the Netherlands.

Concept Test

After the interviews, we designed a web application that implemented the main features of our concept. This prototype was used in order to further specify requirements, and to see how users would respond to our concept of social goal setting. We invited participants (n=8, 2 female) to work with the application for one week. We targeted sedentary people that worked in the same office; however, they were not all sedentary, as we observed later.

The features implemented in this application were: activity logging, setting and accepting challenges, sending and receiving comments, and the presence of an expert. This expert, which was actually controlled by one of our group members, was seen as a virtual coach by the users. He proposed some challenges, reminded users of their goals and gave feedback on their actions. We tested the challenge setting in two ways. Initially, by proposing all kinds of different challenges through the virtual coach, and then, by observing what kind of challenges the users themselves came up with. The challenges set by the coach ranged from individual to group challenges, and from very easy opportunistic activities (taking the stairs), to real sports (going for a run). At this stage, we did not use the mentioned activity monitors. We relied on users' input in the web application as to what challenges they managed to complete.

After one week of testing, we interviewed each of the users to gather feedback on the application. In addition, we analyzed the data recorded in the system's database. We found that most users asked for more feedback and information about the other participating users, such as: who is doing what, who completed the most challenges, which ones did they accept, total calories burned, total kilometers walked, etc. Users pointed out that they preferred to accept challenges that were easy to accomplish. As for the rejected challenges, most users said that those challenges were unrealistic, boring, or too difficult. The real sedentary users reported that they preferred opportunistic activities.

Most users liked the system and thought it would work well. Most appreciated characteristics were the social aspect that allowed interacting with friends, and the coach, who was perceived to be a real expert. Most importantly, they reported that it really stimulated them and made them think more about their activities. In addition, all users reported difficulties with checking the system during weekends, because they were almost never at a computer. Therefore, most users suggested a mobile implementation.

Video Prototype and Focus Group

Next, we designed a 4-minute video prototype to illustrate all functionalities of our concept [7]. A focus group was carried out to get feedback on this prototype. This was done to assess people's attitudes towards the concept of activity sharing and monitoring with a challenge setting approach. All invited participants (n=6, 2 females) were office workers. As a start, questions were asked regarding healthy lifestyles and how they defined their own lifestyles. Then, the video prototype was shown, followed by an extensive discussion.

Contrary to the previous concept test, users showed resistance towards the challenge setting approach, fearing peer pressure. They suggested that for the system to be more fun and fair, the person who sends a challenge should also have to complete it. In accordance with the other interviews, challenges should preferably be sent by friends or an expert. Participants appreciated most the idea of inviting friends to perform group activities with them. Participants disliked the alerts and reminders because they could turn out to be annoying. They also suggested integration with their daily schedule.

Most participants agreed that the most important thing on the system would be selfawareness, and that they would like to see their improvement over time. Participants wanted the activity recognition to be reliable and aware of possible cheating. Participants were open to sharing activity information with each other. Regarding the technology, the group thought that the use of a cell phone based system would make the application more accessible during weekends.

Final Concept

We thoroughly analyzed the results from all user-centered design iterations, and extracted a long list of requirements for the concept. Most requirements were already met by the concept, but several requirements demanded some changes. We list the most important changes here.

Overall:

• Users can only be in the same group if they have the same level of physical activity.
• Users in the same group are preferably friends or close colleagues.
• The system provides easy access on a PC (i.e. tray icon, or popup reminder, not only a website).

Challenges

• Challenges will be more structured (what, how long, when, where).
• Accepted challenges will be displayed as such.
• Users will be able to mark a challenge if they do not want to do it, and it will appear as such.
• The system will focus on group challenges and on opportunistic activities.
• The system will launch challenges that fit into users' current activities (level, time, location, required equipment).
• The user who sets a challenge automatically accepts it as well.
• There will be a limited number of challenges per day.

Displayed Information

• The system will provide self-awareness through overviews of user's achievements, like burned calories, etc.
• The system will provide self-awareness through predictions of future status when current activities are continued.
• The system will show group information about how many people did a challenge, how many did not, etc.

Feedback

• The virtual coach will send immediate real time feedback to the user, after fulfilling a challenge.
• Feedback will be grouped per challenge.

Reminders

• The system will persuade users more to send/accept challenges.
• The system will send as few reminders as possible (only when the user is inactive for too long).
• The system will have the capability to be

turned on silent mode, so it will not send reminders.

Using all these insights, we created a highly detailed description plus a UML use case diagram of our final concept. A small version of this UML model is displayed in Figure 1. To do a solid evaluation, we are planning to build a fully functional prototype of our design concept. This will include user access through a PC and through a mobile device, fully automatic measurement of physical activities, and all other aspects of the final concept.

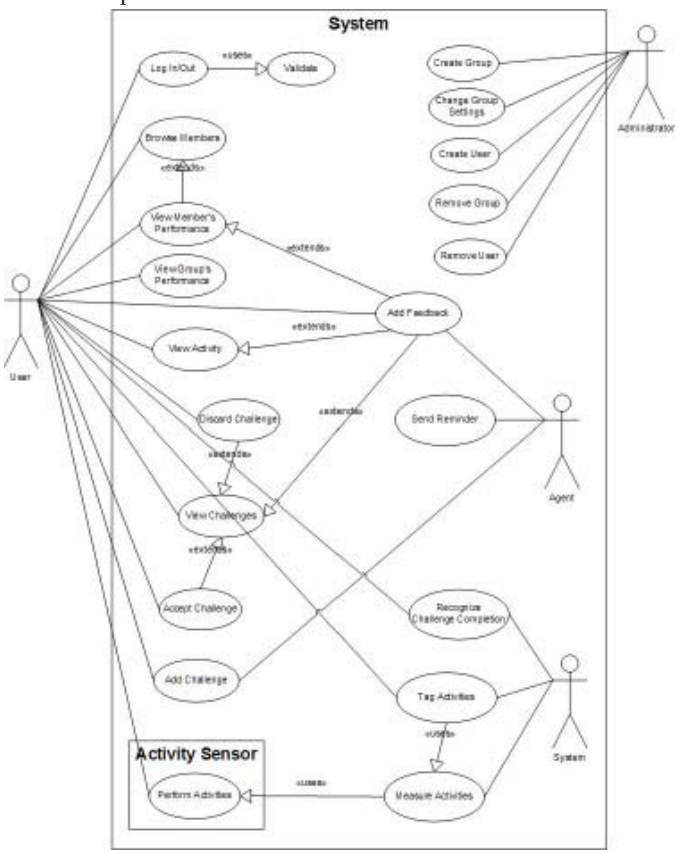

Figure 1

Evaluation

For the evaluation of our final concept, we are planning to invite two groups of sedentary users, where each group consists of at least five close colleagues. Before participating, they will be requested to fill out a short questionnaire (International Physical Activity Questionnaires, IPAQ) [8] to obtain comparable estimates of their physical activity. The results will make sure that the groups will be composed of people with low levels of physical activity. The concept will be tested in a six-week trial, using fully functional prototypes. The first two weeks, we will measure the physical activity of all users, to get a baseline of their activity. The next two weeks, one group will use our final concept, whereas the second group will use a stripped version, with self-monitoring and without social challenge setting. After these two weeks, the groups will switch concepts, so group one will use the stripped version, and group two will use the full final concept. The scheme of our evaluation tests is shown in figure 2.

The stripped version will only have the following three features:

• Overview: The possibility to see the total amount of physical activity done by the user.

• Self-monitoring: A graph displaying the activity done in terms of calorie expenditure in distinct zoom levels (week, day, hour).

• Shared activity: The possibility to see the total amount of activity performed by the other users of the system.

To assess the physical activity increase, we will compare the activity results of the interventions with the baseline measurements. In particular, we will compare the activity increase (with respect to baseline activity) separately for the weeks in which they used the full version and the weeks in which they used the stripped version, to see whether our concept motivates people more than only selfmonitoring.

References

1. Orzano, AJ, Scott, JG. “Diagnosis and Treatment of Obesity in Adults: An Applied Evidence-Based Review”, J Am Board Fam Med 17, 2004

2. Mattila E, Pärkkä J, et al. “Mobile Diary for Wellness Management—Results on Usage and Usability in Two User Studies”, in IEEE Trans Inf Technol Biomed, 2008

3. Lin, JJ, Mamykina, L, et al. “Fish’n’Steps: Encouraging Physical Activity with an Interactive Computer Game”, UbiComp 2006, Springer-Verlag Berlin Heidelberg, 2006

4. Consolvo, S, McDonald, DW, et al. “Activity sensing in the wild: a field trial of ubifit garden”, CHI ‘08, ACM, New York, 2008

5. Weldon, E, Weingart, LR. “A theory of group goals and group performance’, The meeting of the Academy for Management, Anaheim, 1998

6. B.J. Fogg, “Persuasive Technology – Using computers to change what we think and do”, Morgan Kaufmann Publishers, 2003

7. “Design Case Concept - Persuasive Technology”, www.vimeo.com/2170744

8. “International Physical Activity Questionnaire”, www.ipaq.ki.se