StandFit: Fighting Sedentary Work Life

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Abstract
This paper presents StandFit a mobile application aimed at encouraging people to lead non-sedentary lifestyles at the workplace, through simple exercises that can be executed during breaks. Results from a 3-week field evaluation demonstrated that adoption was encouraged by the users' perception of the app as having positive impact on their health. Issues related to the intrusiveness of the notifications sent by the application to the users turned out to influence adoption. The need to support user personalization of the app was found, as well as the need for a more pervasive deployment of these persuasive interventions beyond work settings.

Author Keywords
Persuasive technology, Longitudinal evaluation, Healthy living and wellbeing by design.

ACM Classification Keywords
H.5.m. Information interfaces and presentation

General Terms
Human Factors, Design, Experimentation

Introduction
In recent years we have seen a rising interest and awareness concerning the effects that sedentary lifestyles might have on our health. By sedentary

behaviours, we mean those behaviours or lifestyles characterised by low calorie expenditure level, long time spent sitting at office desks, in cars, buses, and in leisure time [9]. There is evidence that adults who, in spite of regularly doing physical exercise, spend much time sitting, might run into serious health issues [4]. To address these problems, we have developed *StandFit,* a smartphone application adopting the typical approach of persuasive technologies [1,3]. StandFit aims to induce users to adopt a more active lifestyle on their workplaces, through a series of stretching exercises that can be performed during breaks.

This paper presents Standfit and some preliminary results from a 3-week field evaluation involving a target user group of eight participants, who used the application at their workplaces. The study focused on the analysis of log and interview data aimed at identifying benefits and challenges in StandFit usage. The study investigated what kinds of factors can drive adoption of this app and contribute to facilitate the target behaviours. Also, it explored its potential intrusiveness in daily work practices and how to better tune it to the needs and preferences of the target users.

Related work

During the 21st century, the adoption of computers on workplaces has represented a substantial advantage in terms of productivity. Yet, it also had a major impact on our health. It is estimated that we spend 9.3 hours a day sitting down: this amount of time is considerably higher than the amount we spend sleeping (7.7 hours a day). Since the Eighties, the time we spend sitting has increased by 8%, and the obesity rate has doubled, reaching a 30-35% incidence among adults in the USA. In this economic and social context, our everyday life has dramatically changed, and the issue of sedentary lifestyle has become critical.

Research has proved a direct link between sedentary lifestyle and obesity risk, metabolic syndrome, diabetes mellitus type 2 and cardiovascular diseases [5, 7]. The damages resulting from an excessive ergonomic tension on the body - backache and cervical pain being among the most frequent - are often to be added to the above-mentioned effects. These problems can occur in spite of a regular physical activity, as a high level of sedentariness can coexist with physical exercise. Therefore, it is essential to prevent prolonged sedentary lifestyle on the actual workplaces. Breaks are essential to the general wellbeing of employees and also to their productivity level. Taking short breaks from work - simply standing up, then sitting back down and vice versa - does have significant advantages in terms of waistline size, BMI, triglycerides and glucose blood levels [9]. Moreover, a link has been observed between breaks from sedentary work and mood changes.

Smartphones are an ideal platform to monitor people in their everyday life and are increasingly used as persuasive systems. They also provide an easy way for exploiting the social network of their users by increasing peer-support. A growing number of *personal wellbeing applications* is available covering a number of domains, such as healthy diet, physical activity [2], or stress management.

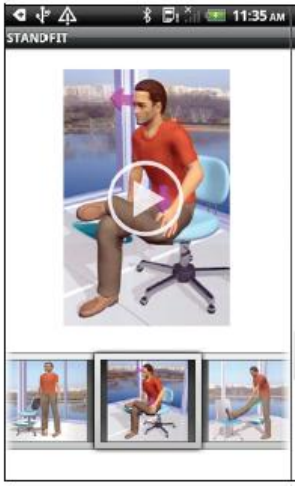

Figure 1. Example of StandFit exercise gallery and video

Figure 2. Historical data report on user level of activity to support self-monitoring

StandFit

Standfit is a stand-alone Android application designed to trigger physical exercise at regular intervals during working hours. The exercises are suggested via a notification message or they can be selected by browsing a gallery. A total of 82 short exercises are available. They are clustered in three sections according to the part of the body they address: "Head and Neck", "Chest and Arms" and "Legs". Each exercise is displayed through a short video by a customisable avatar (Figure 1). The user can customize the frequency of notifications to be received and choose the preferred modality, vibration or ring tone.

Based also on the smartphone accelerometer, the system monitors the user level of activity, by recording how much they are active or not active over a day or week (Figure 2). Users can compare their performance with that of other users, anonymously.

The design of StandFit relies heavily on the knowledge derived from studies on persuasive technology [1, 3]. It refers to motivational strategies based on the user experience, on delivering persuasive content to facilitate user transaction towards more active behaviour, and on proactive interfaces [6]. Stretching exercises are presented in a clear and intuitive way through videos in order to facilitate the execution of the target behaviour (reduction strategy). The delivery device used (smartphone) is already a familiar object, well introduced in the daily practice of users (convenience). The StandFit interface is kept very simple and easy to use. It is designed to foster user motivation by enabling self-monitoring of relevant behaviour (recording number of exercises performed and accelerometer data over time) and social comparison with historical data of other users' performance. The mobile app proposes exercises to counter sedentary behaviour at specific times (e.g., once a user has been sitting for 2 hours at their desk), it provides positive feedback and encouraging messages (including possibility of accessing a relevant *Hints* section) in order to support user compliance with a healthy and active lifestyle. The self-monitoring feature is also designed to provide intuitive feedback and reinforcement of the desirable behavior through colors, which are intended to trigger user self-reflection and positive conditioning in daily life.

The initial design of StandFit was kept quite basic, in order to facilitate a smooth adoption, stable use and appropriation of the app to the daily working practice. At the same time we tried to avoid the risk for users to perceive it as too intrusive and disturbing in their work routines. As it is typical of persuasive technology, the use of the app delivering behavior change intervention needs to be maintained over a certain period of time in order to turn the triggered behavior into a stable habit and avoid relapses into previous behaviors.

Field Study

StandFit was evaluated over a three-week longitudinal study involving 8 participants (3 F; 5 M). Five participants worked as researchers or administrative staff in a reseach centre, spending about 8 hours per day sitting at their desks in front of a PC. Two participants were MSc students at the University of Trento (Computer Science Dept.), another participant was a self-employed consultant in Engineering. All participants were familiar with mobile phones, while only four of them already used a smartphone. We decided to focus our observational study on this small

but diversified user sample in order to explore the adoption and usage patterns of StandFit, as well as to detect any relevant issue or obstacle on its potential adoption. Table 1 below reports a summary of the sample characteristics.

ID	Gender	Age	State of Change	Type	Android	owner
P1	M	29	Maintenance	Researcher	2.3.6	yes
P2	F	28	Preparation	Researcher	2.3.7	no
P3	M	37	Maintenance	Researcher	2.3.6	yes
P4	F	33	Maintenance	Management	2.3	no
P5	F	33	Contemplation	Management	2.3	no
P6	M	33	Maintenance	Engineer	2.3.3	no
P7	M	23	Contemplation	Student	2.3.5	yes
P8	M	23	Preparation	Student	4.0.3	yes

Table 1. Participants' characteristics and state of change according to the TransTheoretical Model of Change

At the beginning of the study, participants were briefed on how to use StandFit, by showing them its main features and customization settings. Participants were interviewed in order to collect relevant information regarding their physical activity routines, sedentary habits and frequency of breaks taken during daily work practice. Their state of preparedness to behavior change was also assessed according to the TransTheoretical Model of Change [8]. The results of their individual assessment are reported in Table 1.

For the following three weeks participants used StandFit in their typical work setting. The application was set to suggest a new exercise every 2 hours, from Monday to Friday, from 7 AM to 7 PM. Over the three weeks observation period, participants were administered a short face-to-face interview every Monday. Different themes were addressed in each interview: the first one was focussed on the user experience with the application, specifically covering issues of usability, privacy, and the effect of the application on everyday routines. The second interview focused more on issues related to user interaction with the customization settings and the self-monitoring feature. The third interview explored the overall effect of StandFit on participants' adoption of a healthier, more active lifestyle at work and collected suggestions for the improvement of the app. All interviews were audio-taped, transcribed, and analysed according to the main themes above. Log data about level of activity, exercise triggering, as well as performance of their activities or their postponement were also automatically collected on the smartphones, in order to assess compliance with the persuasive intervention provided by StandFit.

Results

During the evaluation period participants performed an average of five short exercises per day. In the first week participants were more active than in the following two weeks, however a repeated analysis of variance did not return a significant effect of time. Overall, we observed some influence of the novelty effect, which seemed not to wear off in the subsequent two weeks of observation. The peak use of system occurred between 9-10 AM, and 3-4 PM. The lunch break (12-13 PM) was also a typical time for active behavior. Accuracy of activity level detection was higher for participants who had installed StandFit in their own smartphone and rarely separated from it during the day. Most of the participants who had received the smartphone for the study left the phone on their office desk (sometimes even during breaks or exercise execution) thus lowering the reliability of the

accelorometer data collected and their accurate interpretation during the analysis. A more effective, wearable activity sensors are needed in future studies in order to avoid these types of problems.

StandFit, adoption and user satisfaction based on the interviews showed that seven out of eight participants were highly happy with the app, since they judged it as a useful tool to support healthy living and wellbeing, without being too disruptive of their work practice. P7 was the most negative, since he found the system notifications rather distracting during his studying activity. For this reason he decided to turn the notification feature off while studying. Most participants mentioned they had perceived a reduction in their muscular stress during the period of the study. Interestingly, they soon started to select the type of exercise(s) to perform, rather than do the exercises proposed by the app, which accounted for 42% of the exercises performed. Amongst the reasons reported for this kind of interaction preference were *specific physical needs* of the participants (e.g., neck pain for P2), a desire to *avoid repetition* of the same exercises (P3 and P5), and a need for *minimising embarrassing situations* (P2). The latter concern often arose in participants who shared the office with colleagues, although it did not occur when more than one person in the same room used the app (e.g., P4 and P5). For instance, P2 reported preference of 'feet exercises' as they did not require standing and could be performed without other people noticing. However, this concern was mediated by individual sensitiveness, as P1 said "*I am never embarrassed ... not even with stretching exercises, since I'm already considered the office joker".*

The theme regarding *notification timing* emerged in several interviews. Participants adopted a number of different strategies to avoid system notifications during heavy workload time, and/or in other situations they considered inappropriate to perform an exercise. As reported above, P7 turned the notification off *a priori* to avoid distraction while studying, while P5 never switched it off but simply ignored the notification when the contextual situation made it impossible or inappropriate to execute the exercise. P8 when preparing an exam left the smartphone in another room to avoid distraction, but this was not due specifically to StandFit use, but the need to avoid answering phone calls and sms messages from friends. Six participants preferred to receive notifications through vibration mode, while the other two said they preferred the ring tone since it was easier to notice when the smartphone was in the bag. Most of participants carried out the exercise(s) upon notification or they postponed it for around 10 minutes if they were occupied. P3 preferred to decide on his own when to perform the exercises (often before the notification); he turned out to be quite active during the study and showed signs of tool appropriation (e.g., he revealed to use StandFit notifications as reminders to check new emails received). Regarding self-monitoring, only P5 reported not to be interested in using this feature. P1 and P7 found that data visualization were very useful and effective. P2 and P4 preferred to access the daily reports, while P6, P7 and P8 preferred the weekly reports. Participants also appreciated the use of different colors to indicate different activity levels in the reports. They thought that seeing lot of 'red' colour in their report was quite disappointing (since this meant low activity level had been recorded) but on the other hand it was also stimulating them to take action and

change the situation. The possibility of comparing one's progress with that of other, unknown users, was not particularly appreciated, but this is probably due to our poor design of this feature in StandFit. Participants suggested further development of this app feature by enabling comparison and competition among known users or even among different offices or companies they work in. Integration of this feature with social networks was considered positive by some participants, although one thought apps like StandFit should support intrinsic motivation to healthy living rather than extrinsic motivation.

Conclusion and future work

The study presented in this paper has shown that StandFit was perceived as a useful app to encourage healthy living and avoid sedentary behavior and its associated risks. Issues such as the intrusiveness of the notifications sent by the app came out as a relevant factor affecting adoption. An accurate collection of activity and contextual data seems crucial to further extend the potential deployment of this type of persuasive intervention, even beyond work environment. However, this should take into account the different user preferences and needs. We are currently working at further investigating these needs and refining StandFit according to users' suggestions. For example, it was suggested to extend the app deployment also to domestic environments where sedentary behavior typically occurs (e.g., TV watching) and to offer more room for user's personalization of the app, such as its integration with calendar tools in order to set the days and time when the monitoring and persuasive feedback are mostly needed.

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