Motivating physical activity at work: Using persuasive social media extensions for simple mobile devices

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ABSTRACT

Powerful behaviour change programmes can be developed through a combination of very simple, accessible technology, and an understanding of the psychological processes that drive behaviour change. We present a study in which very basic digital pedometers were used to record the number of steps taken by participants over the course of a normal working day. A Facebook application, named Step Matron, was utilised to provide a social and competitive context for pedometer readings. We were particularly interested in whether interactions between users via the application more successfully motivated physical activity than simply recording daily step counts in a similar application. Ten participants (1 male), all nurses working in a UK hospital, used the application across two conditions over the course of the study. In the socially-enabled condition, participants could view each other's step data and make comparisons and comments. In the non-social condition, participants could only view their own personal step data. A significant increase in step activity was observed in the socially enabled condition. Our findings highlight the potential of social media as a means for generating positive behaviour change. They also suggest that simple mobile devices can function as an inexpensive, accessible and powerful trigger towards this behaviour change without necessitating the use of overly complex and expensive mobile applications or devices.

Categories and Subject Descriptors

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous

General Terms

Design, Experimentation, Human Factors

Keywords

Persuasive technology, lifestyle, health, mobile devices, pedometers

1. INTRODUCTION

Modern lifestyles are becoming increasingly sedentary [10]. In the UK only 11.6% of adults are classed as physically active by taking part in moderate exercise 5 times or more a week [4]. Physical exercise has also been shown to improve health conditions such as heart disease and depression [2]. This paper reports on the use of a simple mobile device (SMD) – a digital pedometer - and a social application to improve physical health in a specific environment: the workplace. As figures suggest that UK workers spend up to 60% of their waking hours at work [9] there is scope to utilise some of this non-social time to encourage more physical activity.

In recent years a number of researchers have conducted studies to evaluate the potential of using pedometers as health interventions in the workplace (e.g. [5], [3]). Chan et al. [3] report a substantial study involving 1442 employees over a 12 week period in which pedometers were used to measure the effects of two types of motivational structures on physical activity. These two motivational structures were; health education (control group), and personal/team goal setting (intervention group). Analysis of the study's activity data revealed that 51% of participants in the intervention group met the US governments recommendations compared to 31% in the control group. It appears that the social interactions and competitiveness engendered by the team goal setting, including the use of posters displaying and comparing team performances, may have had a significant impact on the results observed.

Interestingly, Chen et al. [3], did not utilise any technology-enabled feedback other than the pedometer display itself, in either the control or intervention groups. Thus, the social and competitive feedback presented to participants was indirect, infrequent and over a long period of time. The current paper suggests that offering users more direct and frequent online social feedback, could lead to both a more enjoyable experience for the user and more positive gains in recorded physical activity.

In this study we leveraged an extremely popular contemporary online social network (OSN) - Facebook - in combination with SMD's in order to engage participants in a timely and playfully competitive manner with their step activity. The intention was to demonstrate the value of using an online social application to record data, display feedback and facilitate on-topic discussion, thus eliminating the need for the user to wear anything other than a cheap off-the-shelf pedometer. We are engaged in a number of studies in which we are evaluating the viability of using social

MobileHCI 2010 September 7-10, 2010, Lisboa, Portugal.
ACM 978-1-60558-835-3/10/09.

platforms *in general* to motivate and encourage positive behavioural change. For instance, this approach has been used successfully in raising awareness of the ecological impact of energy use in the home [8].

We designed and developed the Facebook application Step Matron using the Facebook API [6] and then evaluated it through a user study. The user study followed a within subjects design with each participant taking part in two conditions or social modes. In condition A, Step Matron was socially enabled, for example participants could see their friends' step data as well as their own; in condition B the Step Matron application was manipulated so that there were no social features available and so participants could only see their own personal step activity. Our hypothesis was that participants would be more active when using the socially enabled condition of Step Matron when compared to the non-social condition.

2. Experimental Method

2.1 Participants

Ten Registered Nurses (Nine females and one male) were recruited through a personal contact to trial Step Matron. All of the nurses were employed within the same hospital ward and personally knew each other as friends. Additional criteria for recruitment were that they must have been regular users of Facebook for the past 12 months and that all participants must be on each other's friends list on Facebook.

2.2 Design

In order to examine whether the social interaction element of the application was necessary over just recording and displaying feedback, we created two conditions; socially-enabled and non-social. In the socially-enabled condition, participants could view each other's step data and make comparisons and comments. In the non-social condition, participants could only view their own personal step data. The independent variable was therefore Step Matron's interaction mode, either social or non-social. The dependent variable was the number of steps taken by each participant, with a total step count being recorded in each condition for each participant.

The experiment's conditions were counterbalanced to avoid ordering effects. This was done by creating two groups quasi-randomly, each group containing 5 participants. Group 1 started in the social condition, group 2 in the non-social condition and the condition that each participant experienced was switched halfway through the experiment. Thus, each participant experienced both conditions, and order effects were controlled for as carefully as possible.

2.3 Materials

In order to generate activity data that we could use within the Step Matron application we used a commercial off-the-shelf pedometer – the 'Silva Ex3 plus' [12] as shown in figure 1.

Figure 1. Silva Ex3 Plus Pedometer used in study

In the study conducted here, participants manually self-reported their step count data as a task in the Step Matron software. Step Matron then offered users the ability to compare their step data with other users and also to post comments on their peers' activity. Additionally, personalised Facebook notifications were sent to each of the participants in the study who had all added Step Matron to their Facebook profile, as shown in figure 2.

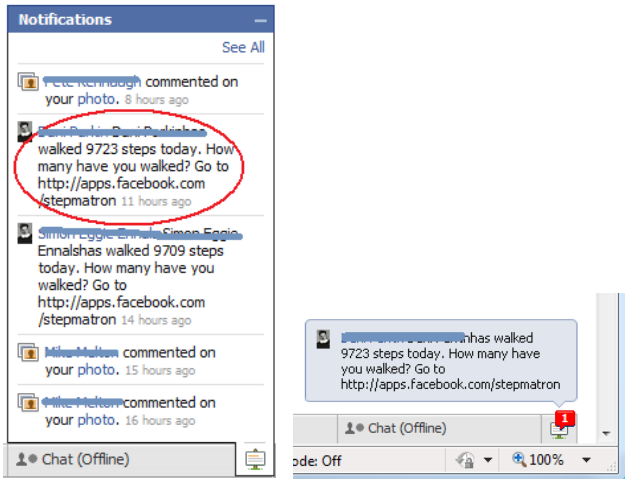

Figure 2. Notifications to other participants who are using Step Matron

A rankings interface displayed the total step count for each participant in a table format with the highest total step count placed at the top of the table. Each participant in the table was selectable for a breakdown of their previous 7 day step count and for personal messaging. At the bottom of the rankings table a *public* comments board was available for posting messages viewable by all. The rankings table provided the competitive attribute of Step Matron - as well as providing an opportunity for social interaction to take place, centred on step activity.

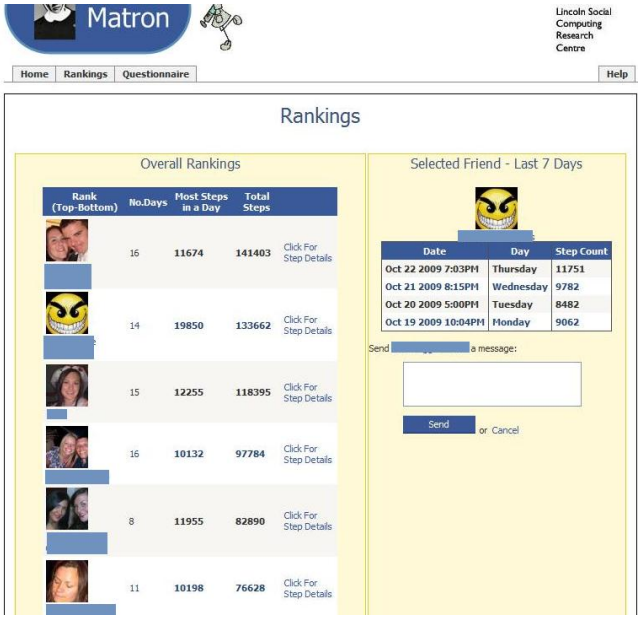

Figure 3. Step Matron Rankings interface

Other goal-driven features were implemented such as displaying who has walked the 'most steps in one day' on the rankings interface with a star rating. This provides the participants with a mini-goal to work towards which supplemented the goal of attaining highest total step count. An overall group measurement was incorporated which showed the total number of steps taken by all participants with the equivalent mileage walked.

Submitted step data from the participants was stored in an MS SQL database, with all data stored anonymously. The Google analytics service was also used to record the number of Facebook application page views for each of Step Matron's interfaces.

2.4 Procedure

Each participant gave their informed consent and undertook the experiment by carrying a Silva Ex3 pedometer during working hours and entering their step data into Step Matron after each working shift was completed. The experiment took place over a period of 21 days with each participant submitting 5 working days of step activity in each condition. Half of the participants started in the social condition with the other half starting in the non-social condition. Once all participants in each group had submitted 5 working days of step data they were sent an email and notification through Facebook informing them of the changeover of conditions. Step Matron was then reprogrammed to perform in the alternative conditions with the relevant participants. Crucially, in order to deter participants from over-reporting step-count data, all participants were briefed at the beginning of the study that the pedometers stored historical activity, and that this would allow researchers at the end of the study to validate the accuracy of all self-reports.

2.5 Results

The steps recorded for each participant in both conditions are summarised in figure 4. Analysis found that 9/10 participants walked more steps in the social condition than in the non-social condition, with mean step ratings of 42004.4 and 38132.1 for social and non-social conditions respectively.

A Wilcoxon statistical test for repeated measures of non-parametric data showed that the total number of steps taken was significantly higher when participants used the social condition ($Z = -2.5$, $N=10$, $p=0.013$).

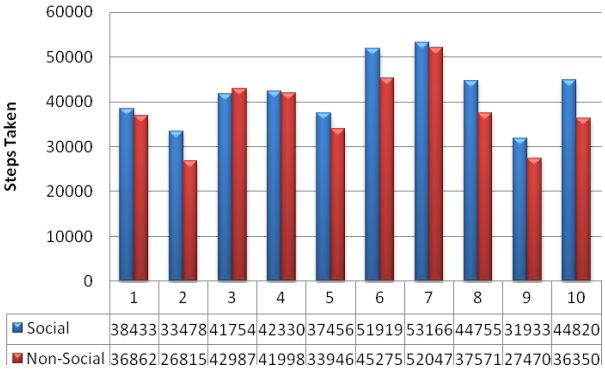

Figure 4: Participant step activity in each condition

Additional data collected from Google Analytics provided an insight into how often the participants across both conditions logged on to Step Matron. In the 21 days the experiment was run, there were 1142 pages views, with 224 unique visits to the Step Matron application, equalling 5 page views per visit. The average time spent during each visit was 6 minutes 11 seconds, highlighting that users of the application were willing to spend some of their own time in interacting with Step Matron. Additionally, the users spent an average of 1 minute 46 seconds on the step input interface, but spent almost a minute longer when interacting with the rankings interface at 2 minutes 37 seconds. It may be assumed that participants enjoyed the rankings interface due to its social and game like properties – a league table and comments board.

3. Discussion

This paper has described the design, deployment and evaluation of a system that utilises a Facebook application to extend and support an SMD in persuading participants to increase physical activity in the workplace. Participants recorded a significantly higher number of steps in the social condition than in the non-social condition. This finding suggests that social interaction over an online social network, such as viewing each other's step counts, comparing own usage to that of peers, and commenting on each other's progress, can help motivate participants to increase physical activity in the workplace.

Comments from the participants showed they enjoyed the competitive aspect with feedback such as "*ooooh im number 1 so far :-)*". Interestingly, a comment was made that moved the context of the physical activity from the workplace out into the personal social space, "*was out dancing fri night, can you imagine how many steps that would have been!!!*" with a response from another participant showing empathy over the 'lost' steps, "*aaahhh shame! Wouldve bin loads x*".

The increased effectiveness of the social condition over the non-social condition in the current study may be explained by literature on social psychology. The desire to belong and willingness to adapt behaviour to follow what others are doing has been seen as a fundamental motivator [1]. Social norms such as peer pressure have also been seen as a means of changing behaviour to align with the ideals or beliefs of groups [11]. Whilst there is insufficient space to give a full account of the psychological theories of social motivation, effecting behavioural change through computer mediated social applications seems promising.

Behavioural change is no easy feat and more often than not technological endeavours fail to make an impression on the target users [7]. It has been suggested that one of the main reasons for this is that designers of persuasive technologies often set goals that are too difficult for users to attain and work towards, ultimately they give up trying. Effectively, the results of this study indicate that the participants themselves can provide motivational goals for each other by simply allowing them to interact over a competitive social networking application.

Interestingly, the current study suggests that SMDs can function as successful triggers for positive behaviour change, when delivered as part of a larger programme. Specifically, the conclusion drawn above was that the social and competitive interactions occasioned by the social version of the Step Matron Facebook application motivated participants to become more physically active during work. However, it is difficult to understand the process through which this competition was maintained, as participants did not have access to the Facebook application during working hours. Rather, participants only had access to a simple digital read-out of their daily step-count from the pedometer during working hours. Thus, it is apparent that the competitive activities occasioned by the Facebook application were not only in action while participants used the application, but also throughout the rest of the day; and that the SMD functioned as a trigger for these competitive activities.

This study also demonstrates that social network applications can serve as a powerful context that allows participants to understand quantitative behavioural measures as more than mere numbers. For example, when participants in the current study occasionally viewed their step-counts while working, it is possible that these were considered not purely as the number of steps taken, but as steps closer to beating their friend, steps closer to winning, or as a performance that needed to change in order to achieve equality with fellow participants. Without the competitive Facebook application, this would not have been possible.

4. Conclusion

The current study demonstrates that the carefully considered combination of two simple technological elements, informed by an understanding of successful behaviour modification programmes, can be effective in motivating behaviour change. This finding could prove valuable when designing the architecture of future persuasive technology, as it suggests that complex applications on complex devices are not necessary to motivate real behaviour change in users. Although the paper describes a relatively small scale study, it provides encouraging results and presents scope for a scalable implementation in a larger workplace investigation. In particular, there is potential to improve the design of the experiment by empowering teams of participants as well as the individuals directly. Future work direction would likely include game like mini-goals for both the individual and team orientations.

5. ACKNOWLEDGMENTS

This work was funded by NHS Lincolnshire. Our thanks go to the nurses of the Haematology units at the Royal Hallamshire Teaching Hospital (Sheffield, UK).

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