Using Personal Informatics to Motivate Physical Activity: Could we be Doing it Wrong?

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Abstract
The global level of obesity and overweight is on the increase. Personal informatics – tools which assist users to collect and view information on their behaviours and habits – could help to reverse this trend by making users more aware of their daily level of physical activity. Most tools available use high-complexity high-engagement interfaces to convey this information. We argue that simpler interfaces may be more suitable for users who are not highly motivated to undertake physical activity. We discuss our recent work in designing and evaluating such an interface.

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Personal Informatics, Physical Activity, Wearable Ambient Display.

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

Introduction
According to the World Health Organisation, over 1.6 billion adults are overweight, with this figure projected to climb to 2.3 billion by 2015 [8]. The global increase in overweight and obesity is attributable to a higher

intake of energy-dense foods, as well as a trend towards decreased levels of physical activity.

Technology, in the form of computers, television etc. is often blamed for this general decrease in physical activity [4]. However technology may actually be useful in assisting people to increase and sustain their levels of physical activity.

One approach is to use a class of tools referred to as personal informatics [6]. These tools assist people to collect and view information on their daily behaviours and activities. Making a person aware of a particular behaviour (sedentary behaviour in this case) may be sufficient to cause them to change it [3].

There are a number of such tools, most of which employ high-complexity, high-engagement interfaces to deliver information to the user. We argue that this approach is sensible for active users who wish to use technology to support their existing physical activity regimes. However low-complexity, low-engagement interfaces, such as ambient displays, may be more suitable for less active users who are in need of encouragement to do more physical activity.

Existing Approaches

There are a number of smart phone apps that utilise phones' integral accelerometers and/or external sensors to monitor physical activity, and then present the recorded information to the user. For example the Jawbone UP system, consisting of a wrist-worn motion detector that interfaces with an iPhone app, which allows the user to track their daily physical activity, eating and sleeping habits.

There are also stand-alone wearable fitness tracking devices on the market, such as Nike+iPod, Garmin Forerunner, FitBit and Polar watches. Some of these devices are aimed towards whole-day activity monitoring and others are aimed towards workout monitoring. However all incorporate an aspect of self-monitoring by presenting the user with information about their current and past levels of physical activity.

In the literature, Consolvo et al. developed a mobile-phone based physical activity journal called “Houston” [2]. Users could enter their daily step counts into the phone and look at trends, goals and averages for themselves and friends who were also using the journal. They later expanded on this concept using a wearable sensor and ambient display [3]. In “UbiFit Garden” certain activities could be sensed automatically and information was presented to the user through a garden visualisation on the phone's screen saver. Butterflies represented goals achieved, flowers represented activity events, etc.

Lin et al. developed a physical activity game, “Fish'n'Steps”, where a user was represented by a virtual fish in a fishbowl [7]. Physical activity, as recorded using a pedometer, would cause the fish to change in size and appearance. When the user consistently met their daily activity goal, the fish would get larger and gain decorations.

Motivating vs. Monitoring

In their evaluation of Fish'n'Steps, Lin et al. categorised users into different “levels” using the Trans-Theoretical Model (TTM). Higher levels represented greater willingness to conform to a desired behaviour (engaging in regular physical activity).

They found that users on the middle levels of the model were more likely to change their attitudes and behaviour. This is intuitive – users who have little desire to change are unlikely to be motivated to do so by technology. Conversely, users who are already exercising regularly are unlikely to need to be motivated by technology.

Different users will employ technology in different roles within their lives. Users who are highly physically active may use personal informatics to support their current activity regime. Users who do not do regular physical activity but who see the need to do so may use personal informatics to help motivate them to change. And people who have little interest in exercise and are unwilling to change are likely to be non-users.

Interface Complexity and Engagement

In realising that users employ personal informatics for physical activity in different roles, we argue that different styles of interaction are appropriate for each of these roles.

Devices such as the UP and Forerunner employ high-complexity, high-engagement interfaces. High-complexity in that a large amount of information is presented to the user, usually in the form of numbers and graphs. Distance travelled, time taken, calories burned, etc. And high-engagement in that users must commit time to regularly monitor and understand the information presented.

Active users who employ technology in a supporting role will value this "rich" presentation of information. Their high level of intrinsic motivation to exercise means they will be willing to commit the time and effort to engage with such interfaces.

Designers seem to assume that less active users, who employ technology in a motivational role, will benefit from the same type of presentation. However this may not be the case. Long-term behaviour change is a slow process, marked by set-backs [5]. By presenting these users with complex information and demanding their constant attention, we risk having them abandon the technology and slip back into old habits.

We argue that low-complexity low-engagement interfaces (such as the ambient displays employed in UbiFit Garden and Fish'n'Steps) may be more effective at motivating users in the long-term. These interfaces should be informative, yet simple to engage with, to prevent user "burn-out". And if users choose to disengage with the interface, they should be able to re-engage at a later date with minimal effort.

Current Work

We have developed and evaluated a device that embodies such an interface – ActivMON (fig. 1). ActivMON is a watch-like device worn on the wrist which incorporates an accelerometer (motion sensor) and LED light. The accelerometer measures the user's level of physical activity and the LED changes colour to show the user's current activity level as compared to a daily goal. Unlike previous approaches, ActivMON is able to alert the user to others' physical activity in near real-time – the LED flashes when other users wearing ActivMON are doing physical activity [1].

ActivMON embodies a low-complexity low-engagement interface – an ambient display. The user is able to

figure 1. ActivMON on a user's wrist.

assess their own level of physical activity simply by glancing at ActivMON on their wrist. If it is red, they know they should do more. If it is approaching green, they know they are doing well. The delivery of information, and the use of that information through self-monitoring, is straightforward and intuitive.

We recently evaluated ActivMON in a two week study with five users, in order to identify and explore any usability issues which could affect further development and evaluation of such devices. We discovered that device size and form, accuracy of activity recognition and battery life were all important factors for user acceptance.

We intend to further develop and evaluate ActivMON using an iterative design process, in order to test our hypothesis that low-complexity low-engagement interfaces are effective at motivating less active users to increase their levels of physical activity.

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References

[1] Burns, P., Lueg, C. P., Berkovsky, S. ActivMON: A Wearable Ambient Activity Display. In *Proc. MMS 2011*. GI E.V. (2011). 11-24.

[2] Consolvo, S., Everitt, K., Smith, I., Landay, J. A. Design requirements for technologies that encourage physical activity. In *Proc. CHI 2006*. ACM Press (2006). 457-466.

[3] Consolvo, S., Klasnja, P., McDonald, D. W., Avrahami, D., Froehlich, J., LeGrand, L., Libby, R., Mosher, K., Landay, J. A. Flowers or a robot army? encouraging awareness & activity with personal, mobile displays. In *Proc. Ubicomp 2008*. ACM Press (2008). 54-63.

[4] Kautiainen, S., Koivusilta, L., Lintonen, T., Virtanen, S. M., Rimpelä, A. Use of information and communication technology and prevalence of overweight and obesity among adolescents. *International Journal of Obesity*, 29 (2005), 925-933.

[5] Klasnja, P., Consolvo, S., Pratt, W. How to evaluate technologies for health behavior change in HCI research. In *Proc. CHI 2011*. ACM Press (2011). 3063-3072.

[6] Li, I., Dey, A. K., Forlizzi, J. A Stage-Based Model of Personal Informatics Systems. In *Proc. CHI 2010*. ACM Press (2010). 557-566.

[7] Lin, J., Mamykina, L., Lindtner, S., Delajoux, G., Strub, H. Fish'n'Steps: Encouraging Physical Activity with an Interactive Computer Game. In *Proc. Ubicomp 2006*. ACM Press (2006). 261-278.

[8] World Health Organisation, Obesity and Overweight: Chronic Disease Information Sheet. http://www.who.int/mediacentre/factsheets/fs311/.