Understanding users' disengagement with wearable activity trackers

Rúben Gouveia, Sergio Barros, Evangelos Karapanos
Madeira Interactive Technologies Institute
University of Madeira
9020-105 Funchal, Portugal
[rubahfgouveia, sergiobarros.159, e.karapanos]@gmail.com

ABSTRACT
With an increasing emphasis on preventive and user-driven healthcare, the market of personal informatics tools for health, such as wearable activity trackers, has received rapid growth. However, recent research has shown that most activity trackers have failed to drive sustained engagement for the majority of users. With this study we present initial insights on a longitudinal study that seeks to understand how users disengage with activity trackers and the role of two design strategies for sustaining users' engagement: *contextual information* and *evolving content*.

Author Keywords
Activity trackers, Personal Informatics, Behavior change

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
As modern medicine shifts towards a user-centered and preventive healthcare model, an ongoing emphasis has been placed on pervasive healthcare technologies to move beyond traditional disease treatment and play a major role in disease prevention. Tools such as activity trackers, which track users health behaviors, have been recognized to motivate healthier behaviors and lead towards disease prevention through all stages of life [1]. However, despite high consumer demand [5], most tools have failed to drive sustained engagement for a majority of users, with studies pointing out that more than half of the users stop using their devices within six months of receiving them [5].

Our main goal is to understand how users engage with these tools in their daily lives and how this relationship evolves over time. Furthermore, we want to make these systems *addictive*, i.e. to explore design strategies that are likely to establish habitual checking behaviors with these tools. We assume that establishing habitual behaviors is likely to lead to sustained engagement with the tool, and possibly to sustained engagement with the behavior change process. To do so, we developed *WalkNRide*, an activity tracker that attempts to sustain users' engagement through two strategies: a) contextualizing users' physical activity and, b) providing evolving content related to users' performance.

This paper describes *WalkNRide* and further provides initial insights of an exploratory study that attempts to understand users engagements with this tool.

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BACKGROUND
Chronic diseases, such as cardiovascular and respiratory diseases, are a major threat to today's healthcare systems, accounting for nearly 40% of mortality cases and 75% of health care costs worldwide [2]. These issues have lead modern healthcare to focus on preventive and user-driven tools that promote behavior changes and healthier lifestyles among general population. One well-known example of these tools are wearable activity trackers, devices that log users' physical activity levels throughout their days. Despite high consumer demand, a recent survey raised concerns over the trackers' capacity to sustain user engagement over the long term [5].

One possible factor leading to users' disengagement with activity trackers stems from an overly focus of the community on *what can be sensed* as opposed to *what can drive behavior change* [1], which is also typically reflected in users' experiences with activity trackers (e.g., "data collection is useful, but after a while you figure out that numbers are just numbers"). Although users appreciate the immediate awareness provided by these tools, the value of its information looses importance over time [4]. This issue has also been discussed in neighboring Human-Computer Interaction (HCI) areas (e.g. research on lifelogging), highlighting the need to move beyond a sole emphasis on *retrieval* (which focuses on gathering as much information as possible from users' lives), towards an emphasis on *feedback* strategies, considering the underlying goals and the ways in which information is presented to users [3, 8].

PROTOTYPE DESIGN & IMPLEMENTATION
WalkNRide is a activity tracking application that takes advantage of mobile phones built in accelerometers to track users daily forms of commute – namely driving (i.e. private or public transportation) and walking. Additionally, it uses

information retrieved from Wi-Fi hotspots to identify daily venues visited by users.

The application's interface (Fig. 1) is split into two distinct sections: the top section presents users current level of physical activity and goal accomplishment. The bottom section splits days into activities, represented by individual rows in the interface. Each row portrays either: 1) a venue where a user has spent at least 10 minutes and respective sedentary level. Sedentary levels are distinguished by color – e.g. red indicates high low sedentary levels at a certain venue, while green low; or 2) a commute activity and respective travelled distance. *WalkNRide* tracks two forms of commute (walking and driving), which are distinguished through a activity detection algorithm that analyzes users movements every 30 seconds. Users can adjust incorrect inferences of walking or driving activities.

Contextualizing physical activity

Li [6] proposes that contextual information (such as location and activities) enables users to correlate physical activities within specific events of their day and *"eventually increase users' awareness of opportunities for physical activity in the different activities of one's life"*.

WalkNRide incorporates contextualized information by tracking visited venues and respective physical and sedentary levels within venues. Additionally, commutes between venues are tracked and presented to users.

Evolving feedback strategies

Consolvo et. al [1] suggests textual feedback as one of the most promising forms of feedback in terms of learnability and novelty, stating that it can "*present people with information about their data that they might not have discovered"*, as well as "*providing suggestions for concrete actions that the user might want to make*." However, the use of textual feedback in behavior change applications is recent and relatively unexplored [1].

WalkNRide identifies patterns in users behaviors and provides recommendations as certain behaviors occur – for example, users are recommended to take a break as soon as static for 30 minutes. Additionally, all activity rows are clickable, portraying messages related to users performances and behaviors – for example, when sedentary for X days in a row, the application provides insights on the consequences of this behavior in terms of future health.

PROTOTYPE DESIGN & IMPLEMENTATION

STUDY

Through our study, we wanted to understand 1) if adding contextual and evolving content could prolong users' engagement with activity trackers and 2) the reasons why users engage and disengage with activity trackers over time.

To achieve our first goal, our application was split into three conditions: A baseline version, containing users' daily goal completion and physical activity level; a "*contextual*" version, which contextualizes users' physical activity according to visited venues; and a "*evolving*", which complements previous versions by introducing textual messages that provide inferences based on users data.

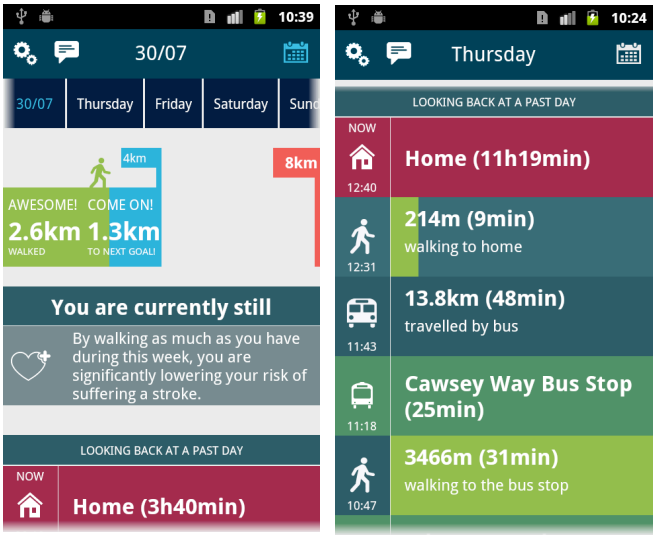

Figure 1. Screenshots of WalkNRide.

Participants

We conducted a four-week observation with a set of 58 users (30 male). Of these, 19 (33%) were randomly assigned to the baseline version of the application, 18 (31%) to the context, and 21 (36%) to the evolving. Users downloaded the application freely from Google Play and were provided with no additional financial incentives.

INITIAL INSIGHTS

In general, users used the app for approximately four days (M = 4.29, SD = 6.46), accessing it approximately 6 times per day (M = 5.79, SD = 6.78), with an average usage duration of 36 sec per day (M= 00:00:36, SD = 00:01:03).

Usage sessions among conditions

In order to develop a richer understanding of usage variations across conditions, we collected the time, frequency and duration of usage sessions.

Participants in the "evolving" condition used the app for more days (M = 5.67, SD = 9.65) as compared to "context" (M = 3.89, SD = 4.42, U= 680.0, $p < 0.05$) and "baseline" conditions (M = 3.16, SD = 2.57, U= 516.0, $p < 0.01$).

No significant distinctions were found in the average number of daily usage sessions among conditions ($\chi^2(2) = 2.76$, $p = 0.25$), however session duration was lower in the baseline condition in respect to the context (U= 20292.0, $p < 0.01$) and evolving conditions (U= 32368.5, $p < 0.05$). Additionally, users would come back to the application more frequently in the context condition when compared to the baseline (U= 19163.0, $p < 0.01$) and context and messages condition (U= 44286.0, $p < 0.01$).

	Baseline	Context	Evolving
Days of usage (SD)	3.16 (2.56)	3.89 (4.42)	5.67 (9.95)
Usage sessions per day (SD)	5.06 (5.22)	8.59 (9.79)	6.52 (7.00)
Session duration (SD)	00:00:21 (00:00:33)	00:00:30 (00:00:52)	00:00:28 (00:00:39)
Time elapsed since last session (SD)	05:27:14 (17:00:02)	3:22:42 (21:17:04)	04:15:52 (11:37:59)

Table 1. Mean usage values among conditions

Further tests revealed no distinctions (Fig. 3) between the level of physical activity among conditions ($\chi^2(2) = 3.42$, $p = 0.67$) or percentage of days in which users overachieved their goal (($\chi^2(2) = 4.13$, $p = 0.78$).

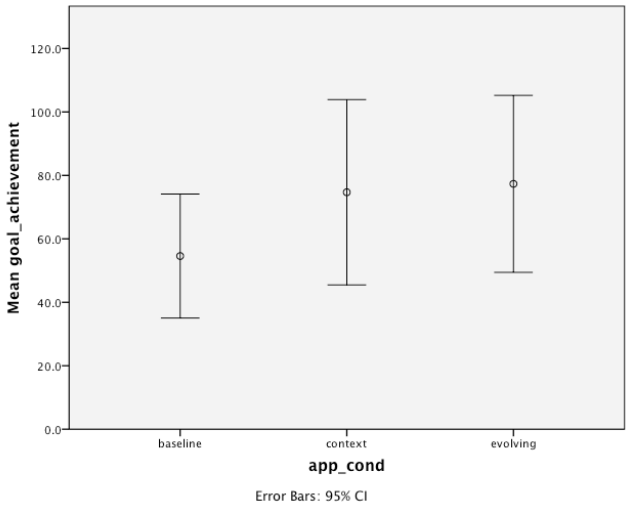

Figure 3. Mean goal achievement among conditions

DISCUSSION AND CONCLUSION

Initial interactions were characterized by higher number of usage sessions, which dropped over time in all conditions (baseline: r = -0.35, n = 34, p<0.05, context: r = -0.36, n = 31, p<0.05, evolving: r = -0.34, n = 66, p<0.01). Our initial insights point out to one main reason - lack of flexibility on adjusting participants' goal accomplishment.

Curiously, users were clueless in terms of goal achievement, with many wondering how much physical activity they should achieve on a daily basis: "[P3] *I'm not sure what my goal should be*". Although well established as a recommended daily walking goal [9], many users could not adapt to a standardized 1000-meter goal, leading to situations of underachievement, feelings of incompetence and consequent product detachment. We feel this relates towards Munson et. Consolvo's [7] suggestion of primary and secondary goals as providing simultaneous goals "*helps participants stretch beyond what they would otherwise have done and gave them a fallback during busy weeks*".

Additionally, contextualizing users data with location-based information provided awareness of the outcomes of their daily activities ([P12] "I had no idea I was so sedentary at work (…) I should really start changing, I'll turn into a vegetable if I keep up with this.").

In terms of evolving messages, participants praise the fact that the application provides insights and inferences, lowering their burden on data analysis and interpretations. As one user stated, "the messages were really interesting (…) It [the app] analysed my behaviour over the last week and helped me understand how sedentary I am".

This paper provides initial insights into users engagements with an activity tracking application that contextualizes information and evolves feedback to prolong user engagement. Additional tests are needed to explore the underlying factors that lead to (dis)engagements with these tools (e.g. is there a relationship between users performance and continuity of engagement? Do users form engagement habits? What leads them to re-engagements with the app?)

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REFERENCES

1. Consolvo, S., Klasnja, P., McDonald, D. W., & Landay, J.A. (2012) Designing for Healthy Lifestyles: Design Considerations for Mobile Technologies to Encourage Consumer Health and Welness. 6(3-4)
2. Ginsburg, P. (2008). High and rising health care costs: Demystifying US health care spending. *Princeton, NJ*.
3. Gouveia, R., & Karapanos, E. (2013). Footprint tracker: supporting diary studies with lifelogging. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 2921-2930). ACM.
4. Karapanos, E., Gouveia, R., Hassenzahl, M., Forlizzi, J. (2014) Need fulfillment and Experiences with Wearable Activity Trackers in prolonged use, Madeira-ITI Technical Report.
5. Ledger, D. and McCaffrey, D. (2014) How the Science of Human Behavior Change Offers the Secret to Long-Term Engagement. Retrieved online from http://endeavourpartners.net/white-papers/.
6. Li, I. (2012). Personal informatics & context: Using context to reveal factors that affect behavior. *Journal of Ambient Intelligence and Smart Environments*, 71-72.
7. Munson, S., & Consolvo, S. (2012). Exploring goal-setting, rewards, self-monitoring, and sharing to motivate physical activity. In *Pervasive Computing Technologies for Healthcare* (pp. 25-32). IEEE.
8. Sellen, A. J., & Whittaker, S. (2010). Beyond total capture: a constructive critique of lifelogging. *Communications of the ACM*, *53*(5), 70-77.
9. Tudor-Locke, C., & Bassett Jr, D. R. (2004). How many steps/day are enough?. *Sports Medicine*, *34*(1), 1-8