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Exploring Walking Activity at Large: Patterns Revealed and Lessons Learned

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Background: Long-term inactivity is associated with the emergence of the obesity epidemic and significant morbidity [1]. Among all physical activities, walking is the most fundamental one [2]. Walking can be measured with smartphone accelerometers [3,4,5,6] and hence, it can be studied in the wild. The knowledge gained from such studies stands to inform increasingly sophisticated interventions, aiming to improve walking behaviors.

Purpose: To sample the user demographics of smartphone walking apps, study their walking patterns, and identify behavioral or usage attractors and detractors.

Methods: We fielded for a year an iPhone walking app. The subjects were the users who freely downloaded and used the app during the study period (n=6,085). Upon registration the user reported her/his sex, age, and BMI. Thereafter, the app recorded walking activity and intensity, communicating to the user its equivalent caloric value (95% accuracy on flat ground) to increase her/his awareness. At the same time, the user was monitoring the walking activity of another user of her/his choosing from the application's user base. This user was meant to serve as a role model.

Participants were 62% female, mean age of 33.9 (range 10-70), with 37.2% normal or underweight (BMI < 25), 33% overweight (BMI 25 – 30), and 29.8% obese (BMI > 30). Walking behaviors were parameterized in terms of intensity (MET) and duration, and conditioned on the user's level of persistence. Subjects who used the app for more than 10 days were characterized as persistent users, offering the most meaningful longitudinal observations.

Results: During the baseline period (first 5 active days), the persistent users had significantly higher mean MET and activity time than the less persistent users ($p<0.05$). The persistent users were also very responsive to software updates. After each software update the walking time and MET of the persistent group experienced a mean increase of 21.1% – a momentum that lasted for a few weeks, before walking activity start ebbing again; the more extensive the update, the stronger the response.

In the weekdays, the mean walking activity was maximum in the pre- and post- work hours with a 20% drop throughout the work hours. In the weekends, the mean walking activity was uniform throughout the day and about equal to the observed maximum in weekdays. There were indications of entrainment between some persistent users and their corresponding role models. Entrainment manifested either as strong correlation or as the absence of significant differences in mean caloric expenditure between the user and her/his role model ($p>0.05$).

Conclusions: Software updates precipitated increased recorded activity in the persistent user group. The fact that this flare-up ebbed after a few weeks and rekindled with the next update,

suggests boredom as the likely underlying process at work; a new or improved app feature appears to act as an antidote. This might inform future intervention design.

The revealed weekday and weekend walking behaviors is what we would expect and stand as qualitative validation for this study. It is also a powerful reminder that office work is a major source of physical inactivity.

What makes some user pairs click? Continuous study of freely entrained pairs may offer new insights that could inform successful behavioral modification strategies.

References

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