Personal Visual Analytics for Self-monitoring

Eun Kyoung Choe
The Information School
University of Washington
eunky@uw.edu

Bongshin Lee
Microsoft Research
bongshin@microsoft.com

Julie A. Kientz
Human-Centered Design & Engineering
University of Washington
jkientz@uw.edu

Submitted to the PVA 2014 Workshop at DIS 2014.

Abstract
We describe self-monitoring as a promising application area to leverage Personal Visual Analytics (PVA). We discuss how PVA can contribute to self-monitoring's data capture, provide insightful feedback, and promote self-reflection. We also describe several challenges that need to be addressed when designing self-monitoring tools in the context of PVA.

Author Keywords
Personal Visual Analytics; self-monitoring; self-tracking; health; self-reflection; self-awareness; personal informatics; feedback; Quantified Self.

ACM Classification Keywords
H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces—Screen design (e.g., text, graphics, color).

Introduction
Self-monitoring (or self-tracking) is an activity of recording one's own behaviors, thoughts, or feelings [5]. The self-monitoring process involves individuals' collecting and reflecting on personal data, making self-monitoring a great application area for Personal Visual Analytics (PVA). Self-monitoring tools involve both data collection and feedback features whereas PVA tools mostly concern with feedback aspects. Self-monitoring

tools' feedback may not always be visual representations (e.g., textual feedback). However, PVA tools provide interactive visual representations as feedback. In a way, a self-monitoring tool is a type of PVA tool if it provides visual feedback.

Designing and developing self-monitoring tools have been an ongoing and vibrant research area in the UbiComp and HCI communities as sensors have become smaller and better integrated with smartphones and other devices. Private and public sectors also push on mobile health (mHealth) innovations as they are promising interventions for empowering people. Many consumer applications and devices are available in the market, which support people's self-monitoring practice regarding health and wellness (see [4] for the overview in this space), work productivity (e.g., [6]), or energy monitoring (e.g., [7]).

In the context of self-monitoring tool design, the UbiComp community focuses on lowering the data capture burden—for example, by leveraging automated sensing—while the InfoVis community deals with designing visual feedback that helps people gain insights through reflecting on their data. However, easing the capture burden and designing feedback are closely intertwined in the self-monitoring tool design. In this paper, we attempt to bridge the gap between the two communities with an aim to design effective self-monitoring tools. In particular, we discuss ways to leverage PVA for self-monitoring's feedback design that improves data capture and self-reflection.

PVA for Self-monitoring

PVA could contribute to many different aspects of self-monitoring such that it can motivate people to capture data, provide insightful feedback, explore data, and encourage self-reflection.

Data Capture and Feedback

One of the design challenges for self-monitoring tools is to encourage continued tracking. UbiComp researchers try to automate the data capture to encourage continued tracking. Unfortunately, automated capturing could easily isolate people from their own self-monitoring practice by making them distant from their own data. However, self-monitoring's benefit mainly comes from people's increased awareness of their own behavior. In this regards, PVA can play an important role in providing insightful feedback to enhance people's awareness and motivation to continue self-monitoring. Continued tracking would allow self-monitoring tools to provide more accurate, higher quality feedback, which in turn could create a desirable feedback loop of continued tracking and increased awareness. Therefore, PVA is an important linkage between people's awareness and motivation to track.

Feedback to Support People's Goals

PVA tools should provide feedback in a way to better support people's goals. Previous literature showed that feedback is especially powerful when people's current state is provided with their goals [3]. Another study showed that certain framing of data influences people's confidence level to achieve their goals [2]. When designing self-monitoring feedback, we need to account for the impact that different designs and framings could have on people. Therefore, before fully implementing the feedback design, we should iterate through

different feedback design prototypes and pick the best design that supports people to achieve their goals. We can test feedback prototypes using crowdsourcing platforms such as Amazon Mechanical Turk to quickly test the impact of feedback.

Data Exploration
Self-monitoring data is a focal point for self-reflection. Most existing self-monitoring tools provide very limited interfaces for data exploration. Aggregated data over time could help people identify trends, highs and lows, and averages. Aggregated data also allows people to compare within themselves—for example, by categorizing data points in several bins and comparing differences across the bins. PVA could help people interactively and iteratively explore their data and find meaningful insights.

Challenges & Other Considerations

Designing self-monitoring tools imposes challenges. Here, we describe some of the challenges that need to be addressed when designing self-monitoring tools in the context of PVA.

Display Size
Many of the self-monitoring tools are either mobile applications or wearable sensing devices, which come with small or even no displays. The small screen size of these devices poses a unique challenge and requires considerable research effort on how to design effective visualizations for devices with small displays [1]. To address this challenge, we can leverage other platforms with bigger displays (e.g., web-based) or devise clever ways to utilize mobile phone interfaces (e.g., display information across continuous home screens).

Real-time Feedback vs. Post-hoc Feedback
Some feedback is provided in real-time whereas others can only be accessed after the data collection is done. These differences depend on the form factor of the device as well as the nature of the data. Examples of real-time feedback devices include Fitbit, a type of pedometer that shows people's step count information from the small wearable display. On the other hand, Jawbone Up Band, a bracelet-type wearable sensing pedometer does not show real-time feedback because it does not have a display on the bracelet. People can check the data from their mobile device after syncing the data. Unlike step count data, sleep data can be logged (in the case of manual tracking) or accessed (in the case of automatic tracking) only when people are awake. Providing real-time feedback is appropriate when people are in a situation where they can intervene their current behavior. On the other hand, visualizing aggregated data over days, weeks, or months helps people's self-reflection on their behavior over a longer-term period.

Visual Reminders
One of the self-monitoring's design goals is to enable continued tracking. This is a challenging goal because people are prone to forget. Visual feedback provided in prominent ways at opportune moments could encourage people to explore and reflect upon their data. To encourage habitual data exploration and reflection, we can leverage both traditional reminders—such as smartphone notifications, emails, and alarms—and visual reminders such as smartphone widgets. A widget containing a daily visual summary could also serve as a quick accessing point to the detailed pages for data exploration.

Conclusion

Many self-monitoring tools exist, but few good tools are sustainable because it is hard to adequately support both the data capture and self-reflection processes. We assert PVA can contribute to self-monitoring. Designing good visual feedback and providing it at the right time can promote both data collection and self-reflection process. Furthermore, the choice of display medium, feedback type, and reminder type matter in designing self-monitoring tool with the help of PVA.

References

[1] Chittaro, L. Visualizing information on mobile devices, *IEEE Computer 39*(3) (2006), 40–45.

[2] Choe, E.K., Lee, B., Munson, S., Pratt, W., & Kientz, J.A. Persuasive performance feedback: The effect of framing on self-efficacy. *AMIA Annual Symposium Proceedings* (2013), 825–833.

[3] Kazdin, A.E. Reactive self-monitoring: The effects of response desirability, goal setting, and feedback. *Journal of Consulting and Clinical Psychology 42*(5) (1974), 704–716.

[4] Klasnja, P., & Pratt, W. Healthcare in the pocket: Mapping the space of mobile-phone health interventions. *Journal of Biomedical Informatics 45* (2012), 184–198.

[5] Kopp, J. Self-monitoring: A literature review of research and practice. *Social Work Research & Abstracts, 24*(4) (1988), 8–20.

[6] RescueTime. http://www.rescuetime.com.

[7] The Energy Detective (TED). http://www.theenergydetective.com.