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*Editorial*

# Editorial of the Special Issue on Quantified Self and Personal Informatics

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In recent years, we witnessed the spreading of a plethora of wearable and mobile technologies allowing for a continuous and "transparent" gathering of personal data. People are increasingly visualizing information about physical activity, health, everyday movements, and mood to monitor their routines, increase their performance, or change their behavior.

Two decades ago, lifelogging research, which originated in research labs, attempted to make everyday recording effortless [1,2], aiming at creating a sort of "total" repository of an individual's life. In more recent years, however, the idea of endlessly hoarding personal information for archiving purposes made way for the ambition of using such information to increase users' self-awareness, highlighting the need to make data useful for their situated purposes. The so-called Quantified Self (QS) movement first foresaw a future when individuals could manage their own data to raise their self-knowledge. Quantified selfers enact practices of self-experimentation in which data are used to understanding the factors that may influence a (problematic) behavior or condition (e.g., a chronic diseases) [3].

In this vein, personal informatics (PI) research attempted to explore novel forms for collecting and displaying personal information. PI researchers aimed to go beyond the quantified selfers' specialized practices, supporting the "use" of personal data in individuals' daily living. There are a variety of domains, such as health, sports, fitness, and transportation, that might benefit from the increased availability of personal information. By making such data actionable, PI research aims at supporting people in understanding the richness of their own digital traces, thus increasing the meaningfulness and value of data.

However, a variety of challenges still need to be addressed in order to achieve such a goal. For example, despite the recent advancements in automation for recognizing and mining emotional, cognitive, and behavioral information, an active role of the user through self-reporting is still required. Data "curation" is burdensome demanding efforts and time to be accomplished. This task cannot be easily managed without strong motivation and compliance over time, so that many users fail to report their data, making the use of self-tracking tools quite useless [4]. It is paramount, therefore, to find new ways for engaging users in actively collecting their data, making this activity more enjoyable and sustainable in their daily living [5].

Moreover, numbers, per se, are not meaningful, and data need to be "narrated" [6] and integrated in the users' personal histories and system of meanings in order to really develop their self-knowledge [7]. Although PI research strived for designing visualizations going beyond stats and analytical representations, for example by using natural language [8], glanceable displays [9], metaphoric depictions [10], and multiple visual cuts [11], there is room for the exploration of radically novel modalities for managing and feeding information back to users [12].

The five papers in this special issue provide a representative snapshot of the personal informatics field, unveiling its current goals and diversity.

Benjamin Johansen, Michael Kai Petersen, Maciej Jan Korzepa, Jan Larsen, Niels Henrik Pontoppidan, and Jakob Eg Larsen explore how personal data can support patients that experienced

hearing loss, by providing more personalized health care interventions. They investigate how to infer user preferences on the basis of user-initiated program and volume changes through Internet of Things (IoT) connected hearing aids. The authors conducted a nine month pilot study investigating interaction patterns with hearing aids, in order to personalize their design by learning from user-generated data. Study results highlight that users engage in different strategies to cope with changing contexts, adjusting their hearing aids to adapt to different situations, rather than relying on a "one size fits all" approach frequently adopted by interventions in hearing health care. These strategies involve not only noise reduction and volume, but also changing the timbre of the sound, in order to optimize the user's listening experience. The authors conclude that empowering users to change settings of their hearing device might increase awareness about how to cope with different sound environments, improving their quality of life.

Ralph Vacca emphasizes how the pervasiveness of mobile devices and wearables might provide new opportunities to support mindfulness practices situated in people's everyday life, where temporary states of mindfulness are cultivated within the context of daily routines. The author presents a new situated mindfulness approach through the Conscious app, which asks users to direct their attention to particular behaviors without engaging them in breathing exercise, rather asking them to be more conscious of it as they continue to go about their everyday life. Experiment results comparing the situated approach with a traditional audio-based mindfulness meditation, and a mind wandering control, point out that the situated mindfulness intervention is able to significantly induce mindfulness states in latter engagements.

Fatemeh Moradi and Mikael Wiberg address the opportunity of using personal data to break the habit of prolonged sitting, by outlining a conceptual framework that accounts for local movement among office workers, in order to inform the design of novel PI systems aimed at increasing physical activity. The framework individuates five agencies shaping office workers' mobility, such as Spatial Possibility, which refers to the opportunities that the architectural space offers for certain movements, and Object Property, which is linked to objects' qualities in the workspace. On the basis of this conceptual work, the authors present two prototypes: the NEAT-Lamp is a sensor-based lamp that can be placed on the table in front of the office worker turning on after 25 min as a reminder that she has been stationary during this time; whereas the Talking Tree is a proximity sensor-based interactive plant reflecting the amount of movement within a corridor by changing color of its leaves. Two observation studies suggest that not only technology, but also social awareness of local movements might support behavior change in office environments.

Federico Sarzotti tackles the issue of collecting data over time, by designing a tangible interface for gathering emotional information. Emotion is a complex construct involving cognitive aspects that are difficult to detect by means of fully-automated tools. Therefore, the author argues for instruments capable of engaging users in reporting their data, by leveraging pleasurable and enjoyable interaction modalities that might counterbalance the efforts required for regularly tracking emotional information. The author describes a "cube" that exploits physical affordance to collect mood states. The user study confirms that tangible interfaces might be an effective means to increase the self-reporting of personal data, emphasizing that such interfaces should allow for the portability of the device, the device maintenance should be kept to a minimum, and reminders should be carefully designed.

Andreas Schreiber and Regina Struminski address the problem of designing visualizations for people who are not familiar with PI devices, who are often unable to understand where their data are stored and accessed. The authors suggest that the provenance of data, i.e., agents, entities, and activities involved in producing a piece of data, can be recorded, analyzed, and displayed in order to help users better understand their own information. The authors, then, present a visualization technique for personal health data provenance using comic strips: such a technique automatically generates a comic strip for each basic activity in the provenance data, consisting of a variety of small drawings providing further details about the activity. These comics allow users to notice crucial points regarding their data,

such as privacy violations. The user study highlights that participants identify themselves with the comic figure, and that comic strips can be an easy-to-understand visualizations of PI data provenance.

Having outlined past and present PI research, we now briefly identify new directions for advancing the field in meaningful ways.

First, PI tools need highly-engaging forms of data collection and exploration. These may be drawn from the world of games. Current PI applications often rely on gamification [13] techniques to motivate their users. However, such techniques are not yet able to provide individuals with a long-lasting and deep engagement, rather supporting mechanical behaviors that might lead to momentary pleasure followed by quick abandonment [14]. Games, instead, might inspire novel designs where users enjoy the data-gathering activity, while seeing data management and visualization as a process of discovery, surprise, and fun, as players experience when exploring a digital game world.

Second, data integration, which is currently a major issue for making PI data really actionable, will likely be less problematic in the near future. A plethora of applications and devices could soon be connected together enabling a variety of new personalized services. It is paramount, therefore, to start reflecting on how we can model such knowledge in order to create "user models" that might take into account the "totality" of an individual's "real-world" information [15]. This would allow for contextual recommendations capable of intertwining different aspects of the user's life, from her health, to her social relations, and from her emotional states, to her physiological parameters.

Third, PI researchers should address their endeavors to turning numbers into meanings, by supporting the individual's interpretative processes and by emphasizing the role of the "self" [16]. To really increase "self-knowledge" and "self-awareness" designers need to understand how data can be connected to users' memories, thoughts, beliefs and wishes, creating tools able to link digital traces to the individual's subjective states. In this perspective, beyond being tools for "doing something", data might become a mirror to reflect the person's interiority, supporting them in better understanding their mind, such as their emotional life. This would meet the original ambition of QS and PI research: increasing "self knowledge through numbers".

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