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# A Human-Centered Conceptual Model for Personal Health Informatics Data

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**Abstract**

Personal informatics is defined as the activity where people collect and reflect on personal data to gain a better understanding of their own behavior. This paper examines personal informatics in the context of health activities and suggests a new conceptual model for self-tracking data through the lens of human-centered theory. In light of this suggested model, the paper concludes with a discussion of forthcoming challenges we will likely face as personal health informatics permeates everyday life and the effect that will have on our socio-cultural values.

**Author Keywords**

personal informatics, health, human-centered computing, activity theory, sociotechnical

**ACM Classification Keywords**

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

**Introduction**

Over the last decade, personal informatics has emerged as an activity enabling people to collect, visualize and reflect on personal information [3]. Also known as self-tracking, self-quantification, and lifelogging, personal

informatics has flourished in the domain of health, where strong demand from early-adopters resulted in the commercialization of a myriad of consumer health devices, from activity trackers to sleep monitors. Although not yet fully mainstream, health-focused personal informatics, which I refer to as 'personal health informatics' is already deeply entrenched in the vision of healthcare that we anticipate for the next several decades, where individuals play an active role in managing their own health.

While personal health informatics (PHI) is largely perceived as a positive development, since it offers people the opportunity to gain a more refined understanding of their health, it is still important to critique it and examine the extent to which the practice might affect our way of life. One important aspect of PHI is that it hinges on the aggregation and sense-making of an entirely new type of data. This presents many difficulties, some of which have already been discussed in the literature [4].

This paper examines PHI through the lens of human-centered theory and suggests a new way of thinking about self-tracking data. It concludes with an analysis of forthcoming challenges we will likely face as personal health informatics permeates everyday life and the effect that will have on our socio-cultural values.

## **A New Conceptual Model**

Over the last thirty years, the amount and variety of data that has become part of our lives through personal computers, mobile devices and the web has steadily increased.

Personal health informatics data, which has emerged in earnest only in the last few years, represents an entirely new class of data. It refers to self-collected data about our health and health-related activities, often obtained autonomously from activity trackers, portable devices and other sensors. It is quantifiable, analytical data about our health, habits and routines.

Developing an in-depth understanding of this data is useful not only because it helps us make better sense of it but also because we can examine it and prioritize it alongside all the other data that is part of our everyday lives. Activity Theory (AT) provides a conceptual framework that helps with this understanding. It has been found useful in HCI and other domains as a way to understand human beings in the context of their natural environments, through the examination and structure of their activities [5].

One of the core concepts in AT is a hierarchical model where all human activities are organized in layers. Activities can be decomposed into actions, which in turn can be further decomposed into primitives called operations. Actions are performed consciously while operations typically take place without individuals being aware of them. Levels of activity can transform into one another, so an action might become a routine operation with the effect of learning (automation), while an operation might come into consciousness (de-automation). As an example, using the turning signals

when driving a car for the first time is a conscious activity for a novice driver; it is an action. For a good experienced driver, the use of turning signals when changing lanes happens automatically, unconsciously; it is an operation.

Popular self-tracking systems like Fitbit, Nike FuelBand and Lullaby sense many types of human activities such as walking and sleeping [2]. They decompose these activities into quantified measures such as number of steps, hours in REM sleep and temperature in a particular sleep environment. It is fair to say that before this category of devices, we were not conscious of how many flights of stairs we climbed on a given day or the exact amount of time spent brushing our teeth. Therefore, from the perspective of AT, it is clear that these systems are actually tracking our routine operations, de-automating them and bringing them to our attention. In practical terms, PHI quantifies a dimension of our lives that we are, for the most part, not conscious of. This stream of data is of interest now because we have collectively understood that these previously ignored quantifiable dimensions implicate our state of health and well being to the extent that we should attend to them. In effect, PHI data constitute the foundation of our health-related activities and behaviors.

### **Cultural and Societal Implications**

What are the implications of paying attention to our personal stream of health-focused unconscious activity data? There is no question that having access to more granular health and well-being data is beneficial and empowering. This is so true in fact, that this emerging type of self-tracking data has become the basis of a

participatory health movement where the axis of responsibility in healthcare shifts more towards individuals and away from institutions. In this new landscape, self-tracking is the norm, and people are in charge of their own health.

Presently, the group of motivated individuals who are actively engaged in the collection of self-tracking data is small. Nevertheless, the number of people adhering to self-tracking is growing very quickly. If a mainstream participatory medicine movement materializes, as many believe and hope it will, certain societal, health-focused expectations and behavior patterns with regards to self-tracking will be established. As history shows us, these transformative patterns and expectations could be liberating, but they might also result in undesirable outcomes.

Cowan provides a cautionary tale regarding the direction technology-based movements can take in her description of how the home, and specifically the life of housewives, was transformed with the creation and affordability of home appliances in the first part of the twentieth century [1]. On one hand, housekeeping routines such as washing the laundry, cooking and personal hygiene were simplified. On the other hand, the structure of the household, standards of household care, and the rationale for engaging in housework tasks changed substantially. Although the "Industrial Revolution" in the home meant that the amount of time and effort dedicated to certain tasks went down, new jobs emerged and new standards and expectations forced housewives to spend even more time than before on certain tasks.

In today's society, there are many stereotypes and perceptions that are directly linked to health (e.g. body weight). Self-tracking data brings to the foreground a new level of quantifiable health parameters that, in the long-term, could become new sources of stereotypes. Moreover, the same way housewives were expected to keep their homes impeccably clean once vacuum-cleaners became accessible, certain expectations might also surface around the activity of self-tracking in the future. As we move forward towards a world of personal health informatics, we should be mindful of these tensions. One of the contemporary definitions of health, produced by the Ottawa Charter of the World Health Organization (WHO), is that health is a "resource for everyday life". In that respect, health is an enabler, a means to an end, and should be treated as such. Obsessing over is likely to be undesirable.

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## Conclusion

Self-tracking data is often thought of in simplistic terms, as nothing more than the data produced by self-tracking devices. As this paper shows, the use of the Activity Theory framework makes it possible to conceptualize personal health informatics data in much more detail. The characterization of the self-tracking process as the de-automation of unconscious operations provides a new perspective on the data, and gives us the opportunity to consider it in new ways, such as how the practice of health lifelogging might implicate our life and values when it goes mainstream.

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