# Toward Critical Reflection: Observing Practices of Noticing to Develop Interventions in Personal Informatics

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## Abstract

Personal informatics technologies, such as Fitbit or mobile diary applications, are designed to help people *reflect* on their behavior and to promote positive behavior change. Although self-reflection is an indispensable component of the interactions with these systems, enabling *critical reflection*, as a means to empower people is often overlooked. We argue that this is because the notion of progress are the dominant narrative mechanisms in the designs of most personal informatics systems. How can we design PI interventions to cultivate the *art of noticing* [16] for enhancing critical thinking on and around self-tracking data and processes? In this position paper, we (1) make a case for incorporating interaction techniques that foster critical reflection in PI systems and (2) present an overview of how we are embodying this perspective in an ongoing research project in which we are conducting Participatory Design workshops to inform the design of personal informatics systems to mitigate or reduce the stresses that are a precursor to burnout. We specifically focus on how we are applying the concept of noticing as a means for scaffolding critical reflection in the design of this study.

## Author Keywords

Personal informatics; self-tracking; reflection; Participatory Design

**Figure 1:** A self tracking tool keeps asking people to achieve their predetermined goals.

## The Dominant Narrative of *Progress* in Personal Informatics

Personal informatics (PI) refers to a class of systems that help people collect data about and reflect on patterns of their behavior to gain self-knowledge and induce a positive behavior change [9]. Since a large variety of personal data can be gathered by ubiquitous and wearable technologies, PI tools have become a popular way to track physical behaviors or mental states in the course of individuals' everyday lives. These tools epitomize the value of *progress*: they are mainly designed to capture longitudinal data and support reflection in generating insights for self-improvement and facilitating behavior change, both grounded in a goal-oriented perspective [9]. When aligned with a measurable and quantifiable goal informed by peoples' overarching lifestyle objectives and values, these tools encourage people to *keep going forward*: steadily building understanding of daily habits and making incrementally better decisions in support of their predetermined goal(s) (Figure 1).

## Types of Reflection

In the body of PI research, *reflection* plays a central role in generating insights about these self-improvement and behavior change activities. Therefore, understanding how people reflect on their data [2, 10] and designing systems that facilitate a reflective practice [4, 8] are the main goals in PI research.

Reflective practice is connected to multiple cognitive processes and results in different outcomes depending on levels of reflection. Baumer [1] theorizes that a process of reflection starts by expressing doubt in a situation, which leads to a revisitation of past behavior. Through this revisitation, people become aware of their situation. According to Fleck and Fitzpatrick's *levels of reflection* framework [5], PI systems generally instantiate a lower level of reflection, which means that these systems focus on a "description of events with or without further elaboration or justification for action in a reportive or descriptive way." This dimension, *self-awareness*, is, Fleck and Fitzpatrick argue, the *initial* point to dive in the reflective practice.

Another dimension of reflection is "the process of conscious, intentional inquiry." (i.e., *self-knowledge*) [1]. In this process, people examine a relationship between two or more data points or work to establish causality between their previous experiences and data [5]. As a result, people are able to gain knowledge to better understand themselves.

Development of a new perspective for future actions is part of other dimensions of reflection. The rhetoric surrounding commercial self-tracking devices and apps suggests that the ultimate goal in tracking data about one's self is to change personal behavior for enhanced well-being, better physical fitness, or to enact positive influence(s) on an environment. This transformative reflection can lead to a change in thinking or habit about what action(s) to take in the future (i.e., *intentional action*) [5].

The last dimension of reflection in the levels of reflection framework is *critical reflection*, which refers to reflection on aspects that transcend the immediate context (e.g., moral and ethical issues) [5]. Sengers et al. [15] explain that critical reflection makes people available for conscious choice beyond an ostensible understanding based on the unconscious aspects of experience. Fleck and Fitzpatrick argue that the other aspects of reflections are necessary precursors of critical reflection. One of the techniques, they
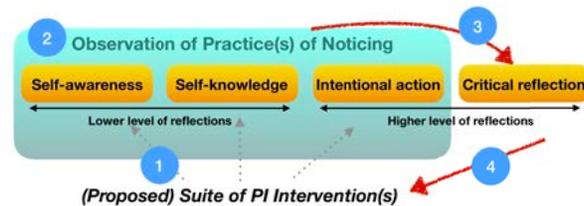
**Figure 2:** Research approach for developing PI interventions to apply the concept of noticing as a means for scaffolding critical reflection. Step 1: Proposing possible PI interventions or creating activities that provocatively represent idealized/anticipated PI interactions; Step 2: Observing participants' responses to these interventions, *paying close attention to cases in which noticing plays a central role*; Step 3. Identify instances that represent movements toward critical reflection; Step 4: Apply "lessons learned" to the next round of design iteration.

suggest, for supporting critical reflection is to make people doubt their original assumptions, leading people to continuously contemplate the mechanisms of and values encoded in a system. To cultivate the ability to *notice differently* and critique representations within PI systems, it is important to understand **when and how individuals interact with the data collected and aggregated by these systems and to examine the in situ reflective practices across all dimensions of reflection.**

## Limitations of Existing Approaches to Reflection in PI Systems

Most reflective practices supported through PI systems' interfaces remain in the lower level of Fleck and Fitzgerald's taxonomy of reflections, centering on gaining an awareness or an understanding of data literally. With these ap-

proaches, people unconsciously recognize their behaviors or emotional states in a descriptive manner, looking at lists of collected data in summarized texts or information visualization [2, 9]. PI systems often fail to draw a higher level of reflections to transform self-knowledge into practice with a critical perspective, mainly because current interventions in the system rarely reveal the internal information process to help people critically reflect on their data.

There have been efforts to provide actionable insights by using machine learning techniques [3, 13]. However, in this interaction, the main agent reflecting on people's self-tracking data is not a human, but the system itself. Since the system maintains control of the meaning-making process on an individual's behalf, the individuals using theses systems hardly generate knowledge beyond information displayed on the system [12].

To help people engage in self-tracking technologies in more ethical, responsible, and durable ways, we argue that the systems should be designed to more explicitly support *critical reflection*. Individuals' awareness about the meaning of their data and helping individuals to "gain insights" about themselves are necessary but not sufficient to bring about an authentically critical perspective. We need to help people notice their data representations on the system differently so that people can be empowered to not only gain insights, but also to question and evaluate the system in order to re-locate the process of "knowing thyself" from the system to those individuals using it. How can we design PI interventions to cultivate the *art of noticing* [16] for enhancing critical thinking on and around self-tracking data and processes? How can we encourage people to reflect on what information is captured by the system but also to reflect on why these data are collected and how they are interpreted, aggregated, and processed by the system?

## Noticing Differently for Making Sense of Stress

One of the possible solutions for fostering increased critical reflection is to apply a notion of ambiguity as a resource for a design in the system. An unexpected design aspect lets people spontaneously engage in a system to make sense of it [6]. For instance, Khovanskaya et al. [7] present a system designed to reveal underlying infrastructure and encourage people to see unnoticed data processing embedded in the interface by raising awareness with provocative design strategies (e.g., displaying the sensitive and highly personal aspects of gathered data). The initiative of the reflective process hinges on the experience of surprise, instead of inevitable results [14].

We are planning to conduct Participatory Design (PD) workshops [11] to explore the potential role of PI systems in mitigating or reducing stresses that are a precursor to burnout. In our forthcoming study, we will observe whether any reflective dimensions emerge as the result of a PD research experience, structured to help uncover the invisible facets of stress as potential inputs to PI systems that can then help to monitor and mitigate everyday workplace stresses. Our workshop will incorporate multiple design activities. We will observe how *practices of noticing* emerge from those activities in which participants take the lead in making sense of their stress and discuss and debate stress management techniques. Our research approach allows us to identify how people *collectively notice* sources of stress and come up with *organic and emergent reflective practices* that participants currently manage (and imagine managing, in the future) stress in their daily lives. We believe that noticing is a precondition for invoking different stages of reflections, but that it also occurs simultaneously with them. Based on our empirical observations, we aim to explore the design of new types of intervention in PI systems to cultivate critical reflection by using the notion of noticing both as a component of our empirical research methodology and as a practice embedded in the resulting PI system.

## Our Goal for the Workshop

Our aims for participating in this year's workshop are: (1) to contribute to a broader discussion about the concept and practice of noticing *in the context of PI systems*, and (2) to discuss our methodological approach to formulate interventions that give people opportunities for seeing differently and making sense of stress in a more critical fashion.

## Authors' Background in this Research Area

**Janghee Cho** is a first-year Ph.D. student in the Department of Information Science at the University of Colorado Boulder, advised by Stephen Voida. He is broadly interested in how people make sense of self-tracking data and machine learning (ML) technologies. The overarching goal of his research is to help individuals gain insights and make decisions about their own lives.

**Stephen Voida** is an Assistant Professor and founding faculty member of the Department of Information Science at the University of Colorado Boulder. He directs the Too Much Information (TMI) research group, where he and his students study personal information management, personal and group informatics systems, health informatics technologies, and ubiquitous computing.

## Acknowledgements

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**Participatory Design Workshop Activities**

**Part 1:** Exploring how people conceptualize and externalize stress with design activities (e.g., clay sculpting, photography)

**Part 2:** Understanding and creating a design space by doing design wall activity

**Part 3:** Discussion of possible design solutions (focus group)

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