Exploring Multistability through Ambiguity for AI-powered Self-tracking Data Representation

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Current data representations in AI-powered self-tracking wearable systems convey an objective, one-fits-all and top-down perspective over tracked activities, often leading to tensions between subjective experience and objectified self, unintended effects, and abandonment of devices. Scholarly design guidelines suggest moving towards more personalized experiences integrating subjective stance in both the data collection and consequent prediction and data representation, however, this is an underexplored field. We argue that multistability and ambiguity could be adopted as research approaches to explore individuals' multiple interpretations of self-tracking data with respect to their personal goals, values and needs. The ultimate goal is to customize data representations through AI.

CCS Concepts: • **Human-centered computing** → **HCI design and evaluation methods**; *Ubiquitous and mobile computing design and evaluation methods*; • **Design**; • **Interaction devices**; • **Interaction paradigm**; • **Artificial Intelligence**;

Additional Key Words and Phrases: interaction design, self-tracking wearable technology, multistability, ambiguity, artificial intelligence.

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1 INTRODUCTION

The promise of consumer wearable activity trackers is to lead their users towards "better" lifestyles. Most people who adopt wearable technologies to measure, monitor and record aspects of their bodies and activities are driven by the desire to improve their own health and performance and to support their wellbeing, self-discovery, and self-awareness [2, 12]. In an effort to make the intangible tangible, these technologies sense body signals and movements, detect activities through ML algorithms, triangulate data, and return visualizations, insights and recommendations as "tools" to empower individuals. The current approach to personal data representation by self-tracking devices is mostly based on screen-based interfaces, quantitative data, numbers, graphs, and recommendations [14] which seem to convey "fair and accurate" [7], objective, and unbiased descriptions of the individual's behavioral patterns, activities, and states [25]. We aim to investigate a different paradigm for data representation, one that leverages multistability, ambiguity, and AI to generate adaptive and personalized representations of data, predictions, and recommendations. The approach we discuss in this work will be the basis for the design of a methodology for UX researchers and designers to explore new ways to represent personal data and to define novel interaction paradigms.

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2 THE MULTISTABILITY OF SELF-TRACKING DATA REPRESENTATIONS

We adopt the postphenomenological notion of "multistability" as a starting point for our reflection. Multistability refers to the potential for a technology to be used for multiple purposes and to be meaningful in diverse ways through various contexts [10, 16]. Multistability entails that the interaction between technologies and individuals is not intrinsic nor deterministic – rather, it emerges from the interplay of the designer's intent, the materiality of the technology, individuals' habits and behaviors, and the environment in which the technology is integrated [5, 16]. The technology materiality contributes to limiting the potential relations (multi) to only certain uses and meanings (stabilities).

What kind of stabilities do current self-tracking data representations support? From the designers and developers' perspective, the intended stability is to promote healthy lifestyles and behavior change [21] through objective, numerical, and performance-oriented data representations. Research on individuals' interpretations of self-tracking devices and data representations unveil other stabilities, among which: historical documentation of activities, diagnosis, [15], self-discovery and self-reflection, research and experimentation, sousveillance and self-discipline [21] etc. However, building personal narratives and sense-making on "objective" data representations requires adequate data literacy, knowledge, skills, and time. In short, these alternative stabilities are not supported by the way self-trackers and data visualizations are designed [14]. Additionally, the way data are represented often generates unintended and sometimes detrimental outcomes, which contradict the original design scope. For instance, objective and prescriptive representations of personal data can be interpreted by individuals as more reliable than subjective experiences [17]. Consequently, the over-trust of data and the reductionist assessment lead, in some cases, to obsessive tracking, data dependency, self-fulfilling prophecies [22] and data anxiety [11]. Designing objective data representations that intentionally support only one dominant stability, therefore, could hinder the emergence of other stabilities which may be more beneficial to some users (e.g., those interested in self-awareness and reflection, rather than behavior change). We argue that designers should expand the current objective and prescriptive representations of data to explore alternative forms of support and interaction paradigms that intentionally support multiple sense-making processes. How can we enable the personalization of data representations that support different scopes and uses of the system and that adapt to different users and contexts?

3 AMBIGUITY AND MULTISTABILITY AS GENERATIVE APPROACHES

3.1 Exploring multiple stabilities through ambiguity

Ambiguity has been frequently mentioned by HCI practitioners and researchers as a productive resource to explore the emergence of multiple co-existing interpretations [1, 6, 18, 20] without constraining systems to be univocal and prescriptive. We believe ambiguity can be adopted as a design and research approach to elicit multiple stabilities to emerge and to support the identification of patterns and proto-practices [18], as well as concealed needs and goals, in users' interpretations and operationalizations of data representations. Building on the ambiguity tactics offered by Gaver et al. [6], we suggest that designers could generate ambiguous data representations by:

Enhancing ambiguity of information. Designing imprecise/incomplete representations of information to stimulate self-interpretation e.g. by implementing multi-modal and sensory data representations through dynamic products [3, 4, 9] and/or bodily experiences as organic faceless interactions [14].

Creating ambiguity of context. Designing "counterfactual artifacts" [8, 24] and "thinking objects" [23], beyond usability and utility, as blank canvases to explore users' appropriations (motivations, contexts, and uses).

Provoking ambiguity of relationship. Crafting more subjective and open-ended data representations to promote reflection on values, identity, and activities. For example, providing the individual with first-person questions and narratives [14], creating "data objects" and "data physicalization" sculptures [13, 19] and supporting the creation of an intimate "material language" to invest the data representation with personal meanings [14].

The implementation of the above tactics in the design of speculative artifacts that offer ambiguous data representations may support the emergence of multiple interpretations and heterogeneous appropriations of the system by users. A multistability analysis could then support the identification of different emerging stabilities, i.e. patterns of users' scopes and sense-making processes.

3.2 Generating multiple data representations according to the emerged stabilities

Based on the outcomes of such explorations, designers can generate diverse data representations to integrate into self-trackers. Such representations will specifically address the multiple stabilities emerged during users' interactions with the ambiguous systems, to support certain users' goals, attitudes, and behaviors. The development of a tailored design for each identified stability will facilitate the transition from "proto-practice to practice" [18]. The analysis of multistabilities could be iteratively adopted to explore how users appropriate newly-designed data representations. Although ambiguity was previously used as an approach for design research, it might also emerge as a defining feature of new types of data representations, where data is not represented objectively but more imprecisely, for instance to encourage self-reflection and exploration.

4 PERSONALIZING DATA REPRESENTATION THROUGH AI

4.1 Making data representations dynamic and adaptive

AI could support further personalization of self-tracking systems, by autonomously adapting data representations to individual users. ML systems can be trained to predict what type of data representation, among the ones intentionally designed to address different stabilities, would better support users in their goals, e.g. choosing one representation supporting self-discovery rather than behaviour change. ML could learn to predict what data representation better suits individual users according to their features, goals, values, behaviors, and contexts. In this new paradigm, we envision self-tracking systems that go beyond personalized ML models for tailored recommendations, to include customized data representations. That would promote users' empowerment, by allowing individuals to access the most effective representation of their data to reach their goals. In a further stretch, data representations could even become adaptive and dynamic, assuming different forms over time to adapt to changing contexts and scopes.

4.2 Challenges

Using AI to autonomously determine what type of data representation better suits a specific user in a certain moment carries the risk of limiting users' choice and to be potentially detrimental if the model is not accurate and the prediction is incorrect. How can we, at least partially, limit these downsides?

- *Explainable AI:* Unveiling and explaining the mechanisms that brought the ML model to suggest a certain type of data representation would increase transparency and allow users to even question that choice.
- *Human agency:* Instead of removing agency from the user, such systems could recommend the most suitable alternative, still allowing users to explore and select other types of data representations. This would also allow to further improve the ML model over time, through continuous learning.

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