Tracking the Experience of Self in Everyday Life

Michael Hoefer
michael.hoefer@colorado.edu
University of Colorado Boulder
Boulder, Colorado, USA

Stephen Voida
svoida@colorado.edu
University of Colorado Boulder
Boulder, Colorado, USA

ABSTRACT

This study explores the potential benefits of an interactive system that supports individuals in collecting data and reflecting on their self-concept and self-aspects in daily life. Through a think-aloud study ($N = 10$) and in-situ deployment ($N = 7$), we design, deploy, and evaluate a self-tracking technology probe. The results suggest that participants found benefit in participating in the study and tracking their self-aspects, with all seven participants in the in-situ deployment expressing interest in continuing to use the system after the study. The study highlights the usefulness of supporting self-reflection at various temporal scales, and has implications for the design of personal informatics systems utilizing the multiple self-aspects framework and Day Reconstruction Method. This research contributes to the understanding of the potential benefits of interactive systems in supporting self-tracking of the experience of self-aspects in daily life.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**; **HCI theory, concepts and models**; **HCI design and evaluation methods**; **Empirical studies in collaborative and social computing**.

KEYWORDS

personal informatics, quantified self, multiple self-aspects, daily life, day reconstruction method, design for the self, think-aloud, technology probe, personal and visual analytics

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1 INTRODUCTION

The experience of *self* is a core component of the human experience, as it facilitates self-awareness [6] and has effects on social interactions, personality, development, affect, and memory [42]. The *self-concept*, composed of multiple distinct (but connected) *self-aspects*, is the mental representation of oneself [33] mediating these effects. While the quantified-self movement (and the research area of personal informatics) seeks to support individuals gathering data about themselves, no existing system explicitly helps individuals gather data about (and reflect on) their self-concept. This gap presents an opportunity for researchers to create interactive systems that support individual development and reflection on an important mental structure, the self-concept.

Our work therefore takes steps towards answering the following research questions:

- **RQ1: How can an interactive system support an individual in collecting data and reflecting on their self-concept and self-aspects in daily life?**
- **RQ2: How do individuals experience using such a system?**

In this research, we design, deploy, and evaluate a self-tracking technology probe that helps individuals gather data about their self-concept, and how their self-concept is experienced in daily life. We conducted an $N = 10$ think-aloud study where participants performed a self-aspect elicitation task [42] and then assigned self-aspects to specific activities of daily life, inspired by the Day Reconstruction Method [30]. $N = 7$ participants continued with the *in situ* deployment, gathering data about how they realized their self-aspects in daily life for up to seven days, and completed a closing interview where they interacted with a dashboard that visualized their self-aspect data.

Our study revealed that overall, participants enjoyed participating in the study and learned about themselves. All seven participants in the *in situ* deployment expressed interest in continuing to use the system after the study (and in recommending it to a friend). The think-aloud study and closing interview revealed that individuals think about self-aspects in multiple ways, that some self-aspects only became apparent when reflecting on one's daily activities, and that comparing a global evaluation of the self with day-to-day experiences of self-aspects could help to better align day-to-day lived experiences with held views of oneself.

Our results suggest that personal informatics systems that support data collection about, visualization of, and reflection on one's self-concept and specific self-aspects in daily life can be useful to individuals and are worth further exploration. We highlight the benefit of supporting self-reflection at various temporal scales, which may generalize to other personal informatics systems. We also discuss design implications for using the multiple self-aspects framework and the Day Reconstruction Method in personal informatics systems.

2 BACKGROUND AND RELATED WORK

The concept of self has been long studied in Western psychology, perhaps beginning with James, who described various "constituents of the self" [29]. This same general idea, that the self is composed of multiple distinct parts, has more recently been formulated as

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the *multiple self-aspects framework* (MSF) [42]. The MSF suggests that the self-concept is composed of multiple, context-dependent components called *self-aspects*. Self-aspects can include roles, social identities, relationships, goals, affective states, and specific behavior tendencies, and are "activated" in certain situational contexts [42]. When a self-aspect is "activated," that part of the self-concept significantly influences affect, cognition, and behavior [16].

A related area of work within HCI is that of *designing for the self*, which focuses on designing products to help people become who they want to be [53] or supporting them in transitions among social roles [54]. The application of the work has been to support *self-extension* in particular roles, when an individual considers the product part of themselves (which has implications for product retention and sustainability), and thereby reflects on their experience of self in everyday life. The phrase "designing for the self" has also been used in regard to supporting individuals in designing their own behavior change interventions [1].

Our work is most closely related to existing research in the field of personal informatics (PI), the study of personal data collection, and the use of PI data in visualization and reflection at the individual level [26, 31]. The field of PI has been informed by the quantified-self community [9, 40], the transtheoretical model of behavior change [47], and stage-based models of system use in daily life [18, 37]. Personal informatics systems, and self-tracking, more generally, have been called a "technology of the self" [20, 21], as most self-trackers are motivated by enacting some improvement to the self (e.g., physical or mental health, finances, relationships, etc.) [41]. Thus far, existing PI systems have focused on domains such as fitness [10, 38], nutrition [12], mood [8], sleep [32], etc., or some combination of these domains [34, 48]. To our knowledge, no existing personal informatics system explicitly supports collecting information about self-concepts and self-aspects, or how they are experienced in everyday life.

From a theoretical perspective, while personal informatics is inherently tied into the idea of a "quantified-self," [9, 46], only recently has a theory of the self for supporting the design of PI systems appeared in the literature [49]. Rapp and Tirassa's "know thyself" theory focuses on a constructivist and interpretivist view of the self, such that the *self* is both subjectively constructed and interpreted by each individual in the moment, rather than being a "database of memories" that seems to pervade the design of other current PI applications [49].

An important direction is that of shifting the focus from external objective behavior (such as step count) towards the "internality of the interacting subject" [49]. In other words, PI systems should not only capture digital exhaust [50] of behavior, but also seek to support the meaningful internal mental activity experienced by the individual. Our work draws on this theoretical approach by directing participant attention towards activation of self-aspects during specific activities of daily life, and providing a dashboard for a gestalt reflection on one's lifestyle.

3 METHODS

Our study consisted of three parts. The first part included an $N = 10$ think-aloud study [36] consisting of a self-aspect elicitation activity [42] and a Day Reconstruction Method task where participants annotated their daily activities with the with specific, activated self-aspects. The second part was an *in situ* deployment where participants ($N = 7$ after three participants dropped out) completed the same Day Reconstruction Method for up to seven days. The third part was a one-hour closing interview ($N = 7$) and evaluation of a visualization dashboard where user-elicited information was displayed[1].

3.1 Technology Probe Design and Data Collection Activities

Technology probes are simple, provocative tools meant to be experienced in a real-world context to explore the potential of new technologies and how individuals interact with them [28]. Technology probes also share similarities with the build-it-yourself–style tools developed by quantified-selfers' to support their homegrown tracking [9], suggesting that technology probes might be an effective way to explore new personal informatics systems. Our technology probe consists of two separate interfaces: a structured spreadsheet where individuals complete specific data elicitation tasks, and an interactive web-based dashboard for viewing visualizations of the data.

To capture a global evaluation of self-aspects, the spreadsheet included a "Self-Aspects" tab (Figure 2 in the Appendix) that prompted individuals to list out their self-aspects (drawing from previous self-aspect and self-concept elicitation studies [42, 51]). For each self-aspect, individuals were prompted to provide a description and positivity rating from 0–10 based on the prompt "how positive do you feel about this aspect of yourself?" (wording from Banas and Smyth [2]). Individuals had the ability to return to this tab at any time to add self-aspects that become apparent to them later in the activity.

To capture the experience of self-aspects in daily life, we implement a version of Kahneman's day reconstruction method (DRM) for the duration of a week in a separate tab (Figure 3 in the Appendix). The DRM asked individuals to break their day up into episodes, describe each episode, and provide additional metadata [30]. The DRM attempts to be a middle ground between experience sampling [14] (close to the moment, but interruptive) and a retrospective logbook study (prone to biases and recall errors [17]). The DRM is similar to traditional time-use studies (see [3] for a short review) in that it results in a complete record of time, but goes further to emphasize "recovering affective experiences" by "reviving memories" [30]. Validation studies have indicated that the DRM is a reasonable approximation of equivalent experience sampling methodologies [30].

Our implementation of the DRM contained one row for each 15-minute segment of time over the course of one week, with columns for participants to enter the activity they were doing at the time, people they were with, up to four self-aspects that were activated, and the strength of activation for each self-aspect (on a 0–10 Likert scale from "no activation" to "most activated" [15]).

[1]Note: this paper presents a small component of a larger study with the same participants, in preparation. Participants also collected additional data about each daily activity, not presented in this paper

3.2 Study Procedure and Probe Evaluation

We began the study with a 1–2 hour combined training and think-aloud session, held over Zoom. First, each participant received an introduction to the theory of multiple self-aspects [42]. After explaining the study logistics, participants were asked to complete the global self-aspect elicitation activity described earlier, while thinking aloud [36]. Then, each participant was asked to complete the activities of the probe for one day while thinking aloud, for either the current day or prior day (following guidelines for the Day Reconstruction Method [39]). The think-aloud method was used to understand how participants thought about their self-concept when using an interactive system.

After completing the think-aloud study, participants were asked to independently complete the Day Reconstruction Method every day for the next 5–7 days (two days could be missed without losing compensation). Participants could add additional self-aspects at any time during the deployment.

After completing this *in situ* portion of the study, the first author manually categorized the self-reported activity data into broad categories for simpler visualizations. An interactive dashboard was created for each participant using D3 [5][2], and shared as a single HTML file. The dashboard consisted of a dropdown menu with three choices of visualizations for self-aspects (self-aspects and activities [detailed and categorized], and self-aspects and people). The visualizations utilize an interactive Sankey diagram (a type of bipartite network visualization) to visualize all self-aspects at once, and their many-to-many connections with either activities or people co-present. Users can hover over particular nodes (self-aspects, people co-present, or activities) to filter down to other connected nodes, enabling exploratory analysis. Each node is also labeled with a total time use and percent of the timespan that particular node represents. To support temporal manipulation [4], the dashboard also contained a date range picker, allowing the participant to view data aggregated across specific date ranges, such as a single day or the entire week.

In the final part of the study, participants completed a one-hour closing interview over Zoom where they explored their visualization dashboard (while thinking-aloud) and participated in a semi-structured interview. Individuals were asked questions about their experience, insights learned, and prompted to provide feedback about the dashboard and study. Audio recordings and transcripts from both the think-aloud and closing interviews were analyzed in MaxQDA [22] using an iterative open inductive coding process [11] performed by the first author in consultation with the second author.

3.3 Recruitment and Compensation

Participants were recruited through email and social media posts in Facebook groups and Reddit subreddits (such as r/QuantifiedSelf). Participation was open to anyone over the age of 18 residing in the United States. Participants were compensated up to a total of $40 for completing the entire study: $15 was awarded for completing the initial think-aloud study, $3 per day up to five days for the daily reflection exercises with the technology probe, and $10 for completing the semi-structured interview and closing questionnaire. This study was approved by the University of Colorado Boulder's institutional review board (IRB). *Note: this paper only reports on part of a larger study. The compensation was provided for the entire study, and not only for the activities described in this paper.*

[2]Utilizing the Viz.js package from NPashaP, https://github.com/NPashaP/Viz

4 RESULTS

4.1 Participant Demographics

Ten individuals participated in the think-aloud portion of the study, and seven completed the week-long deployment and closing interview. Despite recruiting a convenience sample, the reported demographics (see Appendix for Table 1) represent a relatively diverse set of individuals across most categories. Age is one exception, as all participants reported being under the age of 35. As some anonymized participant data will be released as part of the larger study, demographics are presented in aggregate in Table 1 (in the Appendix) rather than on a per-person basis to help reduce the risk of unintentional participant identification.

4.2 Overview of data collected and system usage

All ten participants completed the first 1–2 hour think-aloud session and the Day Reconstruction Method activity for the first day. Seven of those ten completed up to seven additional days of reflection using the technology probe and the closing interview. Collectively, participants completed a combined total of 41 days of Day Reconstruction, representing an average of 4.1 days/person. All seven participants who completed the closing interview expressed interest in continuing to use the technology probe beyond the end of the study at some frequency, ranging from every week to once a quarter.

Participants collectively reported 105 self-aspects, with an average of 10.5 per participant. On average, participants reported 7.9 self-aspects during the self-aspect think-aloud portion of the study, and added, on average, 2.6 self-aspects some time later during the reflection exercise. This finding suggests that some self-aspects are not readily available during a global evaluation of the self, and may only become apparent when reflecting about activation of the self during daily activities. For example, P10 decided to add a new *providing value* self-aspect after not finding a suitable self-aspect from the initial list for a work activity: "What is it? Worker? Learner? Student?"

Participants reported a combined total of 662 activities, for an average of 66 activities per person and 16 activities per day. On average, participants associated 1.1 self-aspect activation ratings with each activity. The maximum number of self-aspects associated with an activity was four. This aligns with the maximum number of spaces our probe allowed for reporting self-aspects, indicating the possibility that activities could be associated with more self-aspects than our probe made room for.

4.3 Think-aloud on self-aspects

4.3.1 Methods of Identifying Self-Aspects. During the initial self-aspect elicitation task, participants were asked to share their thoughts aloud while coming up with their self-aspects. Most participants quickly identified an initial set of self-aspects, seemingly automatically. These initial self-aspects tended to be significant social roles. For example, P1 initially came up with the self-aspects *husband* and

father, simply saying, "I'm a husband…I'll say that I'm a father," or P4 saying, "I am a son." P9 said, "The first thing I'm going to put is daughter... because it's the easiest thing to think of."

Participants also determined self-aspects based on frequency of time spent with the self-aspect activated. For example, "I'm very spiritual when it comes to my time... I don't encroach on the time I set aside for God" (P7, explaining their *spiritual* self-aspect). Participants also thought about self-aspects based on their affinity for situations where the self-aspect was activated: "I like to play football, I like to exercise very well... when I play ball, I feel alive" (P7, explaining their *active* self-aspect), or P10's *naturalist* self-aspect, "I really like being in nature."

Some participants had difficulty completing the global self-aspect elicitation task. P8 said, "there's just so many parts of myself and it's overwhelming to think about all of them and try to categorize them." P7 described coming up with self-aspects as finding "everything I really wanted to be...anything that's part of me."

4.3.2 Assigning Positivity on Self-Aspects. Participants tended to use different heuristics to assign positivity scores to each self-aspect during the initial self-aspect elicitation task. For relationship-based self-aspects, individuals tended to rate positivity based on how they viewed the relationship, either from a historical perspective ("I'm skeptical how my dad treats me sometimes," P3) or from a day-to-day perspective ("If a day goes without me calling, she would be frustrated," P3). Other times, positivity was based on self-perceptions in the context of the relationship ("I'm doing good at being a boyfriend" or "I haven't failed as a brother," P5).

For activity-based self-aspects, positivity was generally assigned based on perceived competence at the activity ("I know a lot about plants and animals," P10) or enjoyment of the activity ("I like engaging in it," P5).

P7 wanted to assign negative activation to self-aspects—in particular, a negative value for the "active" self-aspect while checking emails. Although our 0–10 scale did not enable individuals to report negative activation scores, self-aspect inhibition has been noted to occur when self-aspects conflict with certain contexts [27].

4.4 Reflecting on Visualizations of Self-Aspects

The dashboard presented visualizations of self-aspects elicited via a global evaluation alongside the activation of those same self-aspects in daily life. As such, the system made visible differences between individuals' perceived selves (or, perhaps, ideal selves [24]) and the way(s) in which they actually live their lives. All participants elicited self-aspects related to family, and many participants were surprised to see they spent relatively little time with their family-related self-aspects activated. For example, when P8 looked at visualizations of their self-aspects (such as the one shown in Figure 1) they said,

> "So I have nothing for 'daughter,' so maybe that should be telling me something... and also nothing for 'sister.' Hmmm. Maybe I should have a weekly Zoom call...with my family." -P8

P10 also realized they spent very little time with family in daily life, saying, "I had 'daughter' as one of my self-aspects, but in this week I did nothing to contribute to this... which may mean that I need to... updating my family on how I'm doing and like, asking that in return." Similarly, P6 noticed very little time spent with a religious self-aspect activated, saying, "I think I need to improve on my spirituality."

P5 saw the possibilities of using such a tool to focus on meaningful or productive activities, saying, "[the system] can prompt me to try to do things a bit differently, because if I analyze the time I spend on something and I don't see a lot of value out of it, then it can be motivation for me to change the way I do things." P6 expressed similar sentiments, saying, "this will enable me to know... where I need to put more effort. With this data, I think I can be more productive each day."

5 DISCUSSION

5.1 Design Considerations for Personal Informatics

To our knowledge, this technology probe and visualization prototype represents the first attempt to use the Day Reconstruction Method (DRM) [30] as part of a reflective personal informatics system. A benefit of using the DRM in our probe was its ability to capture a complete record of the day, as opposed to an experience sampling method, which only provides momentary snapshots of experience [23]. While most personal informatics systems focus on a specific domain of life (such as fitness or screen time), the Day Reconstruction Method allowed participants to see everything that they did over the course of a week, with meaningful annotations that *they* provided. Participants identified how this would serve as a useful *technology of memory* [45, 52], with representative reflections including: "this is like putting activities into memory...maybe I forget that I visited [friend], but when I come to this dashboard and open it, I can even... remember what I discussed with [friend] that day. So to me this will work like a memory, kind of" (P3).

As mentioned previously, participants, on average, identified roughly two self-aspects during the Day Reconstruction Method exercise that they did not previously identify in the self-aspect elicitation activity. Self-aspect research tends to rely on selection of standard self-aspects (such as *with friends* or *at home* [7]), card sorting [43], or by having participants identify the "meaningful aspects of their lives" [42]. These global measures are noted to suffer from limited introspective access [42], but to our knowledge, this is the first study to identify improved self-aspect elicitation through structured reflection on daily life.

As individuals elicited self-aspects in different ways, we suspect that by prompting the individual to think about self-aspects in daily life, they engaged in different cognitive processes (such as episodic memory recall) than were used in the global self-aspect elicitation task. Prompting a different kind of cognitive process helped individuals report a more complete self-concept. This finding suggests that PI systems that are focused around "internality of the interacting subject" [49] may be most effective when prompting individuals to engage in a diversity of cognitive processes as a way to capture a more complete representation of the user's mental contents.

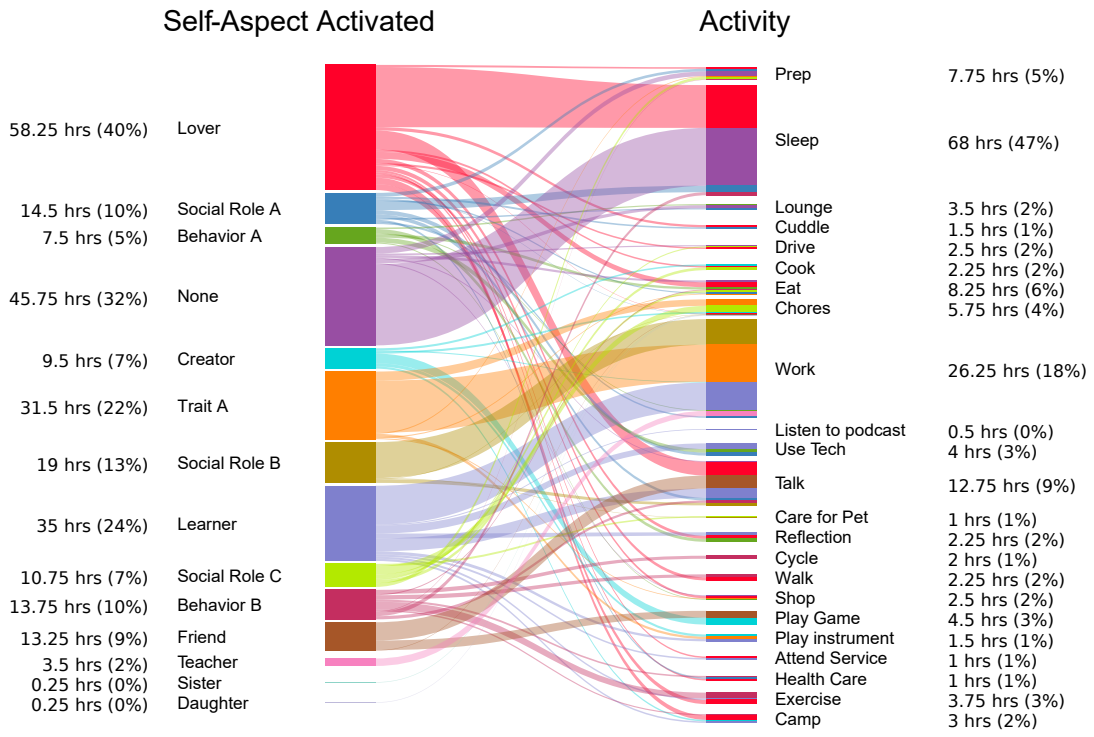

Figure 1: Visualization of a participant's (anonymized) data showing the co-occurrence of activities and self-aspect activation. Individuals can hover over self-aspects and activities to dynamically filter the display.

5.2 Reflecting on External Representations of the Self

As Levebvre puts it, people "do not know their own lives very well, or know them inadequately" [35]. We see a small example here, in that all participants who saw visualizations of their data (the seven who completed the final interview) reported having learned something about themselves, and most (5/7) said they would change something in their life in response to what they had learned. Multiple individuals were surprised when seeing the visualization of their data, prompting them to imagine lifestyle changes that they may not have considered earlier. This suggests the individuals were in the *pre-contemplation* stage of behavior change (according to the transtheoretical model), which is notoriously difficult to design interventions for [47].

The technology probe was designed to gather both a global assessment of the self (via the self-aspect elicitation task), along with a day-to-day record of how the self is activated (the lived experience of the self). We then presented external representations [13] of both the "global self" and a "lived self" in the dashboard, aggregated from records of daily activities. For some participants, the combination of the global self-assessment (seeing oneself as a son, daughter, etc.) and the day-to-day record (seeing no activities of time spent with family) made discrepancies between the participant's current behavior (lifestyle) and a goal state (ideal self) particularly salient. While this is a known behavior-change technique [44], it is notable that our system was not designed with any behavior change intention. Simply prompting individuals to create representations of themselves and facilitating a comparison between those representations of the self with the participant's lifestyle resulted in participants identifying areas of potential behavior change, resonating with previous thinking about designing for the self and self-driven behavior change [1].

This observation suggests a useful strategy for personal informatics systems, more generally— to facilitate meaningful and/or concretely grounded reflection across different scales of the self. While Rapp and Tirassa's theory of self for personal informatics largely distinguishes between temporally ordered selves (such as past, present, and future selves) [49], our findings suggest that the self can also be engaged with at different scales (of size). Both the self-aspect elicitation task and the Day Reconstruction Method arguably resulted in representations of "past selves," in that they were constructed from memory. However, the scope of the "global self" was much larger, in that it was constructed from a participant's entire life (and entire self-concept). The "lived self" was constructed by aggregating a week's worth of data, in the form of 15-minute segments of self-aspect activation. The "global self" represents an elicitation of the individual's mental model of themselves, which, when visualized externally, and compared to aggregated "lived selves," can lead to cognitive dissonance [19], driving individuals to adjust the lived self to meet their model of their global self (as suggested by self-discrepency theory [25]).

Our system resulted in the generation of insights simply by prompting individuals to elicit their *actual* self. We could imagine that a more effective system for behavior change might incorporate elicitations of possible "future selves" [49] or "ideal selves" and use these data to create visualizations that highlight the concurrence (or dissonance) between these actual and ideal selves. Future work can also include designing systems that support these visualizations in other contexts beyond time-use, such as financial transactions (money use).

6 CONCLUSION

In conclusion, this study aimed to explore the potential benefits of an interactive system that supports individuals in collecting data and reflecting on their self-concept and self-aspects in daily life. Through a think-aloud study and *in situ* deployment, we designed, deployed, and evaluated a self-tracking technology probe. The results of the study suggest that the system was beneficial for participants. All participants reported learning something new about themselves and expressed interest in continuing to use the system after the study. The think-aloud study and closing interview revealed that individuals think about self-aspects in multiple ways, and that comparing a global evaluation of the self with day-to-day experiences of self-aspects could be helpful in aligning day-to-day lived experiences with held views of oneself.

This research highlights the benefit of supporting self-reflection at various temporal scales and granularities, and has implications for the design of personal informatics systems utilizing the multiple self-aspects framework and the Day Reconstruction Method. Overall, this study contributes to the understanding of the potential benefits of interactive systems in supporting self-reflection and self-awareness, and the importance of the self-concept in daily life.

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A PARTICIPANT DEMOGRAPHICS

Participant Demographics (N=10)	
Age	3 (18 - 24 years old) 7 (25–34 years old)
Gender	6 male (incl. trans m) 4 female (incl. trans f)
Race	6 Black or African American 2 White 1 Asian 1 Other
Parent Status	3 have children 7 do not have children
Employment	5 for-profit organization 1 non-profit 4 student
Income	1 ($1 to $9,999) 4 ($25,000 to $49,999) 3 ($50,000 to $74,999) 2 ($100,000 to $149,999)
Education	1 high school 2 one or more years of college 1 associate's degree 5 bachelors degree 1 masters degree
Location (US state)	3 Colorado 1 Florida 3 Georgia 2 New York 1 Ohio

Table 1: Participant demographics (presented in aggregate to preserve identity).

B TECHNOLOGY PROBE DATA COLLECTION

The images on the following page are screen captures of the data collection component of the technology probe. In Figure 2, participants are asked to elicit their self-aspects. In Figure 3, participants complete the Day Reconstruction Method, and assign self-aspect ratings to specific activities they engage in.

Instructions: Your task is to think of the different aspects of yourself or your life and then provide a description of each aspect. For each self-aspect, please also answer: "How positive do you feel about this aspect of yourself?" on a 10 point scale from 1: 'not at all positive' to 10: 'very positive'

Code	Self-Aspect Name	Self-aspect description	Positivity
SA1	Nurse	I work as a nurse in a hospital	8
SA2	Son	Son to my mother and father	10
SA3	Friend	I want to be a good friend	7
SA4	Father	I am a father to my daughter	10
SA5	Gambler	I spend money gambling	3
SA6	Caretaker	I like to take care of others	10

Figure 2: Screenshot of the component of the technology probe used to capture an individual's self-concept, by prompting them to elicit individual self-aspects.

2	Date	Time	Activity	Who with?	Org involved	Location	1st SA	Strength	2nd SA	Strength
34	8/1/2022	7:45								
35	8/1/2022	8:00	Ate breakfast	Daughter		Home	Father	7		
36	8/1/2022	8:15								
37	8/1/2022	8:30								
38	8/1/2022	8:45								
39	8/1/2022	9:00	Drive to work			Car	Nurse	3		
40	8/1/2022	9:15	Work		Nonprofit Hospital	Hospital	Nurse	10	Caretaker	6

Figure 3: Screenshot of the component of the technology probe used to capture the record of an individual's day, utilizing the Day Reconstruction Method. Individuals record the activities they complete, who they were with, and any self-aspects activated during the activity (along with a strength of activation.