A Design Inquiry into Introspective AI: Surfacing Opportunities, Issues, and Paradoxes

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Abstract

Introspection is the practice of looking inward and examining our ideas, thoughts, and feelings. It involves considering past experiences and asking questions about the future. We report on a design research inquiry that explores Artificial Intelligence (AI), combined with personal data, as a resource for introspection. We investigate how AI might offer possibilities for generating alternative perspectives on one's life to support introspection and paradoxes that this might raise. We describe our design-led inquiry, motivate five approaches to introspective practice as opportunities for potential Introspective AI interventions, and explore them through seven design proposals. Taken together, our proposals provoke questions around how introspective AI might be critiqued, imagined, and designed. We conclude with a reflection on our work and the opportunities it suggests for future research and practice.

Author Keywords

Personal Data; AI; Introspection; Speculative Design; Research through Research.

Introduction

Introspection is the practice of mentally looking inward and examining one's own thoughts, emotions, values, desires, and character [10]. In the psychological sciences, introspection is characterized as the process of explicitly observing and reflecting on one's mental state [9]. Self-introspection in particular represents an important, ongoing practice because it is a kind of regular check on self-development; it helps one take stock of what they have achieved so far in life [22,57]. Importantly, introspection is different from simply reflecting on or recollecting memories; it is the more specific practice of critically assessing key past experiences and patterns in one's life and, based on these critical reflections, asking questions about what has been achieved in one's life and what one wants in the future [76].

Personal Artifacts, Data & Archives

People extend their self through their things and, in this way, possessions play fluid roles in mediating introspective experiences of looking back on the past, contemplating the present, and prospectively reflecting on one's desired future [4,5,37,70]. As interactive technologies continue to become woven into the fabric of everyday life, people's practices have expanded due in part to their growingly diverse archives of personal data [6,23,53,82]. The convergence of social, mobile, and cloud computing services have created a world in which people's everyday lives are captured through explicit and implicit forms of personal data on a greater scale than ever before (e.g., [14,34,52,64,79]).

These shifts have led to a stream of research exploring how experiences of self-reflection are and could be mediated by personal data [40]. A key body of work has focused on the creation of new technologies to attach digital data to existing physical objects (e.g., [48,54,59]). Another growing area of research investigates opportunities for re-experiencing personal digital data, such as digital journals [23], photos (e.g., [11,58,74]), music (e.g., [35,39,51]), audio (e.g., [19,21,54,59]), social media (e.g., [49,56]) and geolocative data (e.g., [44,55,67,78]) to support rich experiences of self-reflection. More generally, a trajectory of research in the design and HCI communities has articulated the need for design strategies to support reflective, curious, and interpretive experiences in people's everyday lives (e.g., [25,27,29]). Taken together, these works demonstrate a breadth of research investigating the role that data plays in supporting experiences of reflection and reminiscence. Yet, they also highlight that considerably less research in the HCI community has focused on the role of personal data in supporting the more specific practice of introspection.

Generating Alternative Representations
Building on many of the works outlined above, Elsden et al. argue there is a need for future research to investigate the design of interactions with personal data that expand beyond "an exclusive interest in performance, efficiency, and rational [self] analysis" [24:48]. These authors make a compelling case for inquiring into how alternative representations of personal data can help people see their life from different perspectives and gain self-knowledge through this process over time. They argue interaction design must expand to include an emphasis on creating personal data "representations that support multiple perspectives rather than reductive explanations" and which embrace "the often complex and ambiguous relationships [we have] with our digital records" [24:47]. The emergence of growingly diverse forms of personal digital records creates new opportunities for people to introspectively engage with their past emotions, behaviors, and experiences bound up in them. Yet, the scale and diversity of personal data archives also present challenges in terms of how patterns across one's life history could be represented in forms that would offer rich, sustained resources for introspective practice.

Exploring AI as a Design Material
In parallel to these movements, Artificial Intelligence (AI) has increasingly become accessible to design researchers (e.g., [20,28,32,38,47,81]). There is a growing amount of design research projects that speculate on the potential benefits and consequences of AI technologies as they are introduced into people's everyday lives (e.g., [42,43,45,46,63,73]. Broadly speaking, AI is the application of statistical models and algorithms through computational systems to complete specific kinds of tasks by using patterns and inferences that are iteratively developed over time. The 'learning' that occurs in AI refers to the process of building models of a phenomenon in the world through training data. While AI can be characterized in these terms on a basic level, when applied in practice it can take on notably diverse forms and, in general, the ways in which it can operate as a design material remain underexplored [7].

There is nascent interest in the creation of commercial products that apply AI to support introspective experiences for mindfulness and "conscious self-discovery" (e.g., [1]). This space is beginning to be explored through AI-augmented journaling (e.g. [83,84]) and dream journaling (e.g., [85]), where AI is used to organize and analyze entries. Nearly all of these applications focus on leading the process of guided introspection (i.e., similar to an audio-book), as opposed to creating new kinds of interactive and evolving resources to support a diverse range of introspective experiences. Additionally, nearly all current AI introspection applications and services exclusively draw on the data that end users explicitly provide them. Conversely, services such as Facebook Memories and Apple Memories use AI to curate personal data for reflection, however, they don't necessarily prompt the intentionality of introspection. In our work, we aim to extend this design space by considering how aggregations of personal data might operate as resources for Introspective AI.

Emerging Challenges
Collectively, the works reviewed here make clear that people's practices of self-introspection are expanding as personal data records increasingly capture our lives and mediate our actions and perceptions in the world. A diversity of approaches are needed to help expand interaction design through new design initiatives that enable people to reflect on their life experiences from multiple perspectives [24]. AI offers intriguing possibilities for surfacing, exploring, and engaging with patterns in and across personal data records. While prior research has explored various ways new technologies might mediate experiences of reflection and reminiscence more generally, the specific question of how AI might be drawn on as a material to design new applications that could support rich experiences of introspection remains is underexplored.

In what ways can the personal data records that a person accumulates in their everyday life support self-introspection practices and activities? What roles might AI play in creating introspective resources through surfacing known, potentially forgotten, or unknown life experiences bound up in the personal data archives people have today? What potential benefits, tensions, and consequences exist in this emerging design space?

Research Objectives & Contributions
The goal of our work is to use design as a way to creatively, imaginatively, and critically inquire into these questions. We want to explore how AI might offer possibilities for generating alternative perspectives on one's life to support introspection as well as paradoxes that this might uncover. Through this pictorial, we describe formative activities shaping our design-led inquiry. We then motivate five approaches to introspective practice as opportunities for potential design interventions and explore them through seven design proposals. Our design proposals are centered around two protagonists (pictured below): *Alison*, a mid-20s professional living in North America, and *Alison's Introspective AI model* which drives the seven design concept proposals, continually learning from data collected from Alison's life to generate various kinds of introspective activities. Taken together, our proposals offer a range of possibilities and consequences that personal data, shaped by an Introspective AI, might hold for mediating experiences of introspection.

Our research makes two contributions. First, it advances the HCI community's understanding of AI-mediated introspection, alluding to potential future product and services forms as well as where tensions might emerge. This helps broaden and define the Introspective AI design space which can be used as a generative resource for future research and practice. Second, our research provides a case demonstrating how speculative design proposals can work to provide insights into current practices and inspire creative responses in the form of new design ideas. This helps support and extend HCI's adoption of speculative methods and approaches to probe on potential technological futures and raise questions about their desirability.

Design Research Approach

Our approach unfolded over one year where the research team engaged in several different activities simultaneously: an ongoing review of literature on self-introspection theory, methods, and practice; a hands-on exploration of several available AI systems; and numerous introspective activities performed by ourselves. We also generated design concepts directly in dialogue with insights emerging across our first-hand experiences. Through this complex and intertwined process of ongoing reflection, a set of five themes emerged that shaped our inquiry into Introspective AI and our final seven design proposals. These themes are not mutually exclusive, nor conclusive. Below we briefly annotate a sample of key activities in our approach that led to each respective theme.

Casual Introspection through *Short Prompts*

Introspection can be practiced at any time, both as in-depth sessions or in *brief moments* [83]. This theme explores how AI could trigger short, contextualized moments of self-awareness for one to introspectively reflect on.

IBM Watson Personality Insight API [86] and Receptiviti Personality Insights [87]showed emotional trends in our personal journal entries.

📁 Dream Journal_Jan 17, 2020 (3).note
📁 Dream Journal_Jan 14, 2020.note
📁 Dream Journal_Jan 7, 2020.note
📁 Dream Journal_Jan 3, 2020.note
📁 Dream Journal_Jan 2, 2020.note
📁 Dream Journal_Dec 31, 2019.note
📁 Dream Journal_Dec 29, 2019 (3).note

To engage in introspective practice, we completed dream journals. Prompts about the general atmosphere, specific feelings, and occurring persons helped in manifesting these journals.

Custom introspective prompts were written from close friend's journal entries.

Location Data

You walked 38% more on the right side of this street. What makes you stick to this side?

Peronality Insight

Today you felt a high urge of curiosity and increased levels of closeness.

You said you want to stay in your flat, but data indicates you are miserable at home. Move out immediately!
↳ Emotion Flag

An early concept where a widget prompt shows a tension between the user's actual behavior and ideal self.
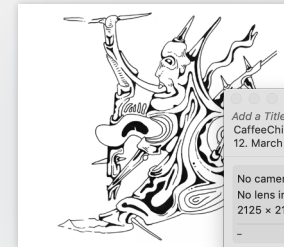
Add a Title
CaffeeChinatown.jpg
12. March 2020   13:29:54

No camera information
No lens information
2125 × 2125   465 KB

I sketched that in a nice caffe in chinatown while giving me a break from all this study madness. Had a good afternoon just doodling my time away :)

Keyword

Short journaling activities to generate self-reflective meta-data on personal artworks.

You *say* you want to go out drinking, but you *really want* to have a *relaxed evening* and *get up early* for a hike. (82.39%)
↳ Value #38
↳ Value #12

Is this assumption correct, Peter?

FALSE   INVESTIGATE   TRUE

You *say* you want to go out drinking, but you *really want* to have a *relaxed evening*, and *get up early* for a hike. (93,15%)

+11%

A speculative product that explicitly asks the user if its assumptions about them are correct.

A gig economy service that teaches new Introspective AI models what it means to be human.

This is an old bridge, as a child I liked to jump into the water from here.

Joshuar Barnes
URBAN CLASSIFIER

MEMORIES   42
OBJECTS   87
ASSUMPTIONS   32

Supporting Collaboration and *Alignment*

A key part of introspective practice is considering if the vision of one's ideal future self has changed [77,89]. As one's Introspective AI develops, it may recognize deficiencies in its model, prompting the collection of more data on its behalf to bring it back into alignment. This feedback loop also applies the other way around as one might detect shortfalls in the model and then train the AI to better conform to one's perceived sense of self.

Sad ✏
60 Image Samples
🎥 Webcam   ⬆ Upload

We trained a model to classify our facial expressions that grew more complex over time.

This led us to examine our own self-awareness on the *authenticity* of our gestures and how others perceive them.

Early sketch of User-AI cycles of collaboration and alignment.

● Human reflect
● System learns

3

Row 1: Confrontation and Critical Reflection

PETER (HUMAN)
Rachael, play Portishead - Roads.

Rachael Tyrell *AGE 2 YEARS*
Lyrics:
Musical Tone:
Community:

Why Portishead?
Peter, are you sad?

PETER (HUMAN)
Mhhm, I guess so.
At least a bit...

Rachael Tyrell *AGE 2 YEARS*
I don't understand.
How can you be "a bit" sad?

PETER (HUMAN)
Rachael, can you just Play the song? I need this now!

Rachael Tyrell *AGE 2 YEARS*
Ok! But after that, you have to define what you mean by beeing "a bit" sad. Unless you want to listen to Happy by Pharell Williams.
Lyrics:
Musical Tone:
Community:

RACHAEL plays...
Roads
Portishead

An AI that holds you hostage for more introspective data.

What would a conversation with my Google account reveal about me?

PREMIUM
What Might The Others Say?!
Find out who is mentioning your name, in what contexts, when and how often.

your name was mentioned **24x** in **Jenny's** speech tracking.

Pay to find out what people are saying about you behind your back to enhance your self-awareness.

Confrontation and *Critical Reflection* →※←

Active inward confrontation of one's self and potential biases is an important part of introspection [84]. Rather than acting as a 'neutral' observer, your Introspective AI can present personal data and assumptions in the form of confrontational prompts that are to be critically examined and reflected on.

Row 2: Introspection through Guided Sessions

An interactive application that we created to synthesize artwork from one's most listened to albums with personal artwork, to create a new resource for personal reflection.

How could a visualized report of recorded speech mediate introspective experiences?

Which of the following statements is close to your "self"?
You take pleasure in ...   You take on any challenge
You need stability   You are traditional

Is that true?
"Country music is really growing on me!"

You are unlikely to
✗ like country music
✗ hold traditional values
✗ fix your typos when writing to someone that you don't want to impress

You and your Introspective AI model take a personality test. Compare your results!

Sleepify
revisit the land of dream
Dream
Daily Dream
Curated by REM
START JOURNEY

Sleepify
Dream mining, Music & Audio
Zur Wunschliste hinzufügen
Installieren

Face your **Nightmares**   Podcast **Sub conscious mind**   **Lucid Tracks**

Sleepify is an app that analyzes your sleep data and creates playlists to reflect on your subconscious.

Introspection through *Guided Sessions*

Guided sessions offer structured pathways for introspection, with a distinct beginning, middle, and conclusion to the experience [91]. Your Introspective AI can be leveraged to generate introspective journeys focused on personally relevant life experiences, value tensions, and dilemmas.

Row 3: Introspection through Open-Ended Session

I wasn't feeling very well.

```
{
  "text": "I have had especially in the last, I would say
  "score": 0.762914,
  "label": "positive"
},
{
  "text": "I wasn't feeling very well.",
  "score": -0.98488,
  "label": "negative"
},
{
  "text": "I couldn't quite get out of bed in the morning
  "score": -0.919504,
  "label": "negative"
}
```

Analyzing emotional sentiment in journal entries with IBM Watson [86] and plotting the results on an interactive canvas using a t-SNE algorithm [75].

Own Artwork   **This experiment ended.** Click Next to review and save your model.   **AI Result**

Teaching a model with our personal artworks and then documenting our reflections on the new resources the machine has generated.

What does it feel like to encounter AI interpretations of our own aesthetic? What does it tell us about our practice and our sense of self?

1995 1997 2003 2007 2010 2014 2016 2018 2020

Mapping personal history through music, from childhood on.

We created vision boards that helped us reflect on the influence of the close relationships in our lives, respectively.

We visually mapped how our aesthetic tastes evolved over time.

Chiara and I were hiking in a big river valley. Over the river there were two huge bridges to the other bank, one of the bridges was broken. The whole dream had something of an end-time mood (Chernobyl vibes) as if something terrible had happened back then when the bridge got destroyed.

Transforming textual dream journal entries into dynamic images, using Runway ML [88] to create new resources for introspection.

Introspection through *Open-Ended Session*

Introspection can unfold in more open-ended ways with no stringent narrative or objective goals [26]. As open-ended experiences, AI-generated introspective journeys emphasize interpretive experiences where new insights may emerge out of moments of serendipity and inspiration with a particular phenomenon with strong emotional resonance (e.g., music [81]).

Framing & Speculation of Introspective AI

Across our process, we wanted to move away from portraying AI as a single 'all-knowing' agent that is always right or that takes on a human-like form. In parallel to recent work in the design research community [7,80], we do not view AI as possessing the same form of reasoning that people have and the uncertainty that comes with this difference can be seen as an opportunity for design practice to generatively engage. We envisioned Introspective AI as a context-aware agent that mediates inter-actions between Alison and her personal data by making inferences about her life through situated introspective prompts. We also wanted to antici-pate and embrace 'mistakes' that an Introspective AI will make and explore different ways that these imperfections in Alison's model could be handled in constructive ways through design.

We also aimed to speculate on future forms of personal data mining where deeper layers of data extraction exist and "the process of quantification is reaching into the human affective, cognitive and physical worlds" [13]. If the future of data mining generates datasets that encompass the human psyche, conscious, and unconscious desires, private and public accounts and idiosyncratic traces of Alison's behavior and activities, then how might these collective resources be leveraged for her benefit by her Introspective AI? Through several rounds of developing, refining, and reflecting on design concepts in the Introspective AI design we eventually arrived at seven distinct design proposals of Introspective AI products. On the pages that follow, we detail each design proposal, and its broader significance.

**1** **Data Extraction: Alison's Everyday Life**

2 **Design Proposals of Introspective AI Products**
We frame Introspective AI as a mediator and translator of vast, rich personal data records. Influenced by the five thematic qualities detailed on the prior two pages, the following seven proposals are intentionally designed to support specific introspective activities. Each proposal is composed as a specialized Introspective AI product and a narrative scenario illustrating Alison's interactions with it.

3 **New Data, Teaching & Learning**
Throughout the suite of services, Alison creates new data that manifests insights about her introspective journey. Her interactions with and across the suite of services become more refined over time.

5

Design Proposals: A Suite of IAI Products
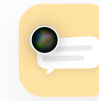
Everyday Personality
Highly contextual introspective prompts delivered opportunely.

Short Prompts   *Confronting*

Music Reflection
Augments Spotify's data with personal data, to generate novel introspective prompts, which feeds back in an affective layer.

CORRELATION
2 similar moments, 2 years appart.

Short Prompts

Mind Probes
Prompts subjective data-collection activities that generate synthesized introspective experiences.

Collaboration & Alignment   *Open-Ended Experiences*

Vision Shrine
A ludic representation of one's ideal self, mediating rich introspective interactions.
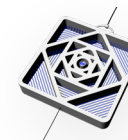
Confronting   *Collaboration & Alignment*

Hello, Cyber-Self
A confrontational manifestation of inferences that the IAI model has gathered which can be corrected to bring it closer to alignment.

Confronting   *Guided Session*

Dream Streams
A bridge from inherently introspective dream-data to experiential services for conscious interaction.

Guided Session   *Open-Ended Experiences*

Deeptalk Report
A meta-analysis of conversational data to generate well-curated, guided, and unique introspective representations.

Guided Session   *Confronting*

Everyday Personality

Everyday Personality presents a chatbot interface that delivers *short introspective prompts*. This Introspective AI service uses its deep understanding of your behavioral data to intervene in everyday life with tailored short introspective prompts delivered at opportune moments.

1 Everyday Personality is aware that Alison has just met up with her childhood friend, Julian, for the first time in four months. As self-monitoring can be effective if practiced while the social interaction is still vivid [71], the Introspective AI service prompts Alison to reflect while she is waiting for the bus home.

> How was is catching up with **Julian** today?

> The bus isn't due for another **14 min**.

> Let's take a moment to write down what you expected from the meeting.

> I thought we catch up and he would ask more questions about my life at the moment. I was really anticipating meeting him, and actually just having a fun afternoon. It's been so long.

> Ok, and what happened in reality?

> I just felt our conversations got stuck. Neither of us were really present! We were just gossiping about things that

Alison's Ideal Self

Your beer consumption is rising! 📈 Up **0.7** cans per **Day**.

CONFLICTS WITH ↴

"I really want to be more healthy, and do more workouts to strengthen my back"

2 Everyday Personality has detected that Alison's evening plans are incongruent with its understanding of her ideal self. It chooses to intervene while she is booking an Uber.

Reflection
This provocation explores the extent that people may value aggregations of personal data that present unique inferences about their lives and then the roles that these materials might play as resources for self-awareness and monitoring. In this way, Everyday Personality probes on the social acceptability of an application that nudges the user toward reflecting on—or *critically confronting*—their behavior if such trends indicate that they are straying from the shared vision of their 'ideal' self.

Music Reflection

Music is deeply connected to emotions, memories, creativity and personal associations across different stages of life [8]; and, as such, music listening as a practice can offer a key catalyst for supporting experiences self-reflection [17,31] and introspection [69]. The data generated from digital music listening is rich with possibilities to generate new insights about individuals, such as their personality (e.g. [2]), especially when aggregated with other streams of personal data. How could such extensive personal data records offer a resource for supporting situated experiences of introspection over time? This space is explored through Music Reflection, a Spotify integration that generates *short introspective prompts*.

1 It's 4:30am. Alison is writing her thesis. Dagger by Slowdive plays in the background.

PROMPT

Cast your mind back to your life in Tel Aviv. You've been here for 6 weeks. It's late spring and the poinciana trees are in full bloom.

`Extract.Sentiment;`
`Update.Recommendations;`

→ **What did you value?**
→ **Who were you afraid of?**
→ **Who did you miss?**

Pay attention to how much has changed.

PLAYING FROM ALBUM
Souvlaki

CORRELATION

You also listened to this **Song** at **4:30**AM, **2 years** ago in your home in **Tel Aviv**.

META — AWARE

This song moves me...two years ago I was not in the best mindset place. I was alone, I couldn't find a job and everything felt... off. Now I'm in a new place...on the other side of the world. Hearing Dagger is a strange comfort!

Reflection
This proposal is bound up in speculation on the possibilities of commercial predictive AI services when augmented with affective data points. It builds on the space created by Spotify's own research into the relationship between music listening practices and personality [2] to explore how integrating a personal AI model with an existing data-driven commercial service could result in more personalised prompts and music listening experiences—but also the new vulnerabilities that might arise.

Mind Probes

As a person encounters new experiences across different stages of life, elements of their identity may stabilize while others could transform [4,6]. An essential part of introspection is looking inward to assess one's emotions and desires in light of personal growth and perceived sense of self [66,76]. If AI applications begin to extend a person's practice of introspection, how should this ongoing dialog be designed? In what ways could a longer-term collaborative relationship between a person and their Introspective AI be nurtured?

Mind Probes is a smartphone app that works in tandem with external hardware sensors: sound, color, smell, haptic and vision. It prompts the user to collect sensory stimuli from the material world that reflect social and emotional associations—connecting inward associations with encountered phenomena. Mind Probes encourages introspection through long-term activities akin to a scavenger hunt that that supports *collaboration and alignment* through *open-ended experiences*.

3 As Alison continues to collect phenomena for her different thematic prompts, the Introspective AI is constantly analyzing the disparate data. It makes a complex inference: Alison's relationship to her parents' divorce has changed. To test this hypothesis and generate a unique introspection experience, Mind Probes sets Alison a new task.

Old-toys: +67.3%

Sounds-of-dispute: +24.1%

Taste-of-tears: +4.2%

Parents-divorce: 95.6%;

OBJECTS
Doubt
2017

TEXTURE
Anger
2018

SCENTS
Bliss
2018

SOUNDSCAPE
Capture the sound of melancholy 🎤

SOUNDSCAPE
Melancholy
2020

SOUNDSCAPE
Melancholy
2021

COLORSCAPE
Compassion
2017

COLORSCAPE
Capture the colors of your parents' divorce. 🎨

2 Alison explores the thematic '-scapes' created from the unique sensor modalities… scents that capture bliss, colors that represent compassion, objects that embody doubt. She presses play, listens, and reflects on how her experience of melancholy has shifted across time.

Laptop fans at 3:40 AM

Neighbors arguing

Crows at dawn

2020

1 Mind Probes prompts Alison to capture sounds that feel melancholic. Over time, these sounds accumulate into a soundscape that represent her current understanding of melancholy.

Reflection
The subtle, often unpredictable qualities of personal growth could make it challenging for the AI to notice and adapt to. This design proposal probes how a personal AI model could be trained intentionally with rich and subjective forms of personal data, and the implications that this has for mediating introspective experiences over time. How can this agency change the relationship between a user and their model?

Vision Shrine

A common future-looking introspective practice asks people to visualize connections between their perceived actual self and their envisioned ideal self [70]. Introspective AI could offer promising resources to support crafting such visions and in prompting one to engage with assumptions about their ideal self in a playful way.

The ludic Vision Shrine device visually manifests a user's goals, dreams, and desires as data collages—an ideal self-canvas that updates in real-time as it consumes their personal data. Drawing on *confrontation* and *alignment*, the Vision Shrine changes the scale of goals depending on how they are being prioritized in everyday life, as an ongoing dialogue between a user's lived reality and their ideal self.

5 As Alison binge-watches tennis videos on YouTube and researches tennis racquets, the Vision Shrine introduces a passion for tennis to the screen and decreases the prioritization of her desire to read books. This passive interaction provokes Alison to contemplate tensions bound to her self-concept and question the consequences of her competing visions.

Future

Reading a Book a Week is Changing My Life

A-book-a-week: -78%;

Load.New-obsession

Tennis-videos: 12hrs;

Artistic-side: +43,2%;

Google-job: -42%;

Photography-work: +17%;

1 Vision Shrine illustrates Alison's goals with data collages.

3 This data is analyzed and a Max Ernst painting appears on the canvas. The size of each image is relative to how important the aspiration is in achieving her ideal self. All visions on the canvas are causally connected—as the painting grows, her career at Google shrinks to make room for it.

4 Alison can haptically interact with the Vision Shrine, pinching and zooming to create a more balanced vision of her ideal future self.

2 As Alison is getting ready for bed, the Vision Shrine asks her a question.

"What are you excited to learn?"

"I would really like to get more into painting on canvas. I mean, I have all the materials, but I haven't found the time....I am so inspired by Max Ernst and the magnificent and vibrant worlds that he creates... I would love to get better with that, and dig deeper into my artistic side"

Reflection
Vision Shrine adopts a playful, ludic [27] framing to catalyze intimate confrontations through changing a user's perceived priorities based on their behavior, raising questions around the ranking of personal desires in the context of one's perceived ideal self. Could a system like this lead to inauthentic visions of one's preferred future? What space is there for semi-autonomous applications that *critically* challenge individuals' current desires in relation to their various future goals?

8

Hello, Cyberself

As AI becomes more sophisticated in understanding and predicting one's emotions, its decision-making processes remain largely hidden to the end-user [13]. This proposal speculates on how one could be offered a playfully *confrontational*, partially *guided* way of engaging predictions generated by their Introspective AI. It probes on how questioning assumptions and *re-aligning* their model could become entangled with introspective practice itself.

Hello, Cyberself offers a conversational window into the assumptions (and biases) that a personal Introspective AI has developed over time. It leverages real-time voice cloning technology [12,33] to speak to you in your own voice. It expresses introspective prompts to you as *you*— embodying your personality traits and beliefs, and then reveals the data 'under the hood' that generated these inferences.

2/12

"I get so passionate about things, that I can't hide it from anyone...but I never follow through because I'm scared of failure."

`Generate.Assumption`

2 Curious about where this statement came from, Alison unveils the inner workings of the model and explores the data points and inferences that generated the statement.

Sentiment talking about: `Painting` `Artschool`

Excitement — 76%

Confidence — 25%

"I love my art, but its kinda quirky"
November 11th, 2019

"I dont even have much to show"
January 8th, 2020

"I am so slow with my painting"
October 13th, 2018

"Art is just not my biggest skill"
January 10th, 2020

Needs

Challenges — 82%

Stability — 57%

Excitem — 75%

48 hours watching Surrealist Art documentaries
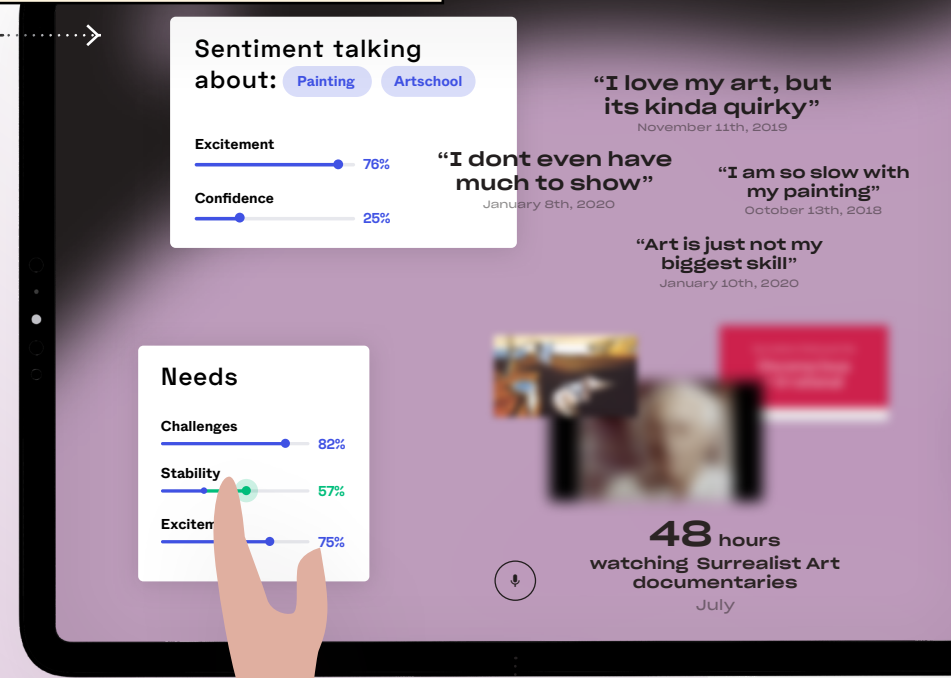July

1 Alison is taken aback by Hello, Cyberself's complex confrontational statement. Is she scared of failure? What role does social interaction have on her creative process? She records her response.

"...Most of the time, when I get really excited about projects, it is while talking to friends. But once I'm home alone I lose that spark...I can't find the inspiration. So yes...Maybe I am scared of failure, but I think really that I need to be with other people, to feel their energy..."

3 Alison can tangibly change values and to add or remove connections between data points—fine-tuning the model's predictions about her behavioral patterns and creating a tighter alignment between herself and her model.

Reflection
Hello, Cyberself enables users to confront factors that shape how their model formulates assumptions that fuel its behavior. This probes at how we can design introspective interactions that support and challenge the idea of *authenticity* in relation to how a person perceives their identity and sense of self. What tensions are created by encountering a digitally-mediated imprint of one's self—does it draw away from the richness of life experiences that are not so readily captured and portrayed by interactive technology or does it create unique introspective interactions?

`Generate.Next-assumption`

"I constantly consume content so that I don't have to be alone with my thoughts."

`Generate.Next-assumption`

I really like being with other people...being incredibly open...but I'd be happier if I said "OK, BYE!" more often.

9

Dream Streams

Dreams offer a way for your subconscious mind to communicate with your conscious self. Dreaming offers an important window into phenomena that shape our innermost desires, fears, and goals [16,62]. As such, dreams can offer important resources for introspection [36,77]. This proposal speculates on how sleep and active recall of dream experiences could be mobilized by an Introspective AI to generate *new open-ended* and *guided introspective* resources.

Dream Streams combines a dreamcatcher-like device paired with mobile applications to offer windows into one's subconscious and open new pathways to self-awareness.

1 Alison is sleeping; Dream Streams is not. It is busy assimilating audio recordings of her—slight utterances and sleep talking—with sleep monitoring data from her smartwatch, smart speaker, and smart mattress pad.

Extract.Sleep-data

Analyze.Sleep-journal

2 As Alison is waking up and fragments of her dreams are still vivid, she is prompted to audio journal.

I had the strangest dreams! I was in a landscape that reminded me of Tel Aviv...with sandy beaches and monolith-like structures, and yet suddenly this was a huge room with pillars of green marble...it reminded me of Gringotts. I felt uncomfortable under the weight of the ceiling. My parents walked in from their bedroom, eyes wide with fear, the rollercoaster...

3 Afterward, Alison looks into the center of the device and is brought back to green marble columns and sandy beaches. She experiences an open-ended impressionistic visual stream of generated media, representative of last night's dream.

Dream Patterns

You have visited **Gringotts** in **7** of your dreams.

— PROMPT —

Explore these journal entries and consider how Harry Potter has shaped your moral compass.

A Strange Journey

My perspective morphed once again to a very fast flying mode and, this was leading into a big rollercoaster, a bit like Gringotts at Harry Potter. I flew this rollercoaster in first perspective and landed in a

Goblin Office Hours

He sorted through parts of the weapons and had a second room where other co-workers worked in Gringotts. His office was a quite small and oldschool like room and he seemed to be very relaxed

4 Dream Streams also prompts Alison with a guided introspective activity. The connected Dream Patterns app quantifies trends in Alison's dreams and prompts her to dissect recurring patterns, such as locations, characters, or specific fears.

Uniquely yours
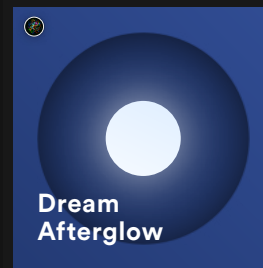
Dream Afterglow

Dream Afterglow
The songs that take you back into your dreamy mind.

5 As Alison is commuting to work, she wants to return to her subconscious world—she listens to the Spotify playlist that Dream Streams produced from its interpretation of her dreams. This playlist aims to capture the emotional texture of the dream while exploring new songs in its afterglow.
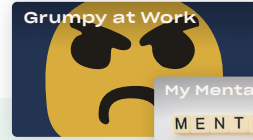
Reflection

Dream Streams explores granting an Introspective AI access to one's subconscious activities and sleeping behavior. What might be revealed through looking inward our self at sleep? Could unknown or forgotten personality traits and orientations be surfaced? How authentic would an AI's interpretation of one's dreams be viewed? And could such perceptions change over time as we begin to understand our dreams from different perspectives as does the AI?

Deep Talk Report

A natural trigger for introspection is socially engaging in deep conversations with trusted companions. Through deep talk conversations, contrasting perspectives on one's behaviors may emerge [22]. Yet, these unique self-awareness insights can be fleeting, fading away soon after the conversation. This proposal explores how an Introspective AI might recognize, capture, and re-manifest these moments at an optimum time in one's future.

Deep Talk Report is an application that audits verbal and written conversations to find and classify deep exchanges. These analyzed accounts are curated *guided introspective sessions* and are also woven together to generate broader thematic reports, which *confronts* users with emerging patterns over time. Themes are further explored through the contextualized introspective activities that are proposed in each report.

1 Alison is at the beach with Helene. She unloads—she is overwhelmed by the pressure of work and the precarity of her life. Always listening, the Deep Talk Report application classifies and analyzes the conversation.

DEEP TALK REPORT
Deep conversation detected.
Now Recording...

2 Friday afternoon, as a part of her introspective practice, Alison opens the Deep Talk Report application to re-experience her recent conversations.

Grumpy at Work

My Mental Health
MENTAL
HEALTH

Paul

4 Alison explores the thematic report about her partner, Paul. She is confronted by the different ways that she talks about her relationship to different people and the different perspectives they hold: her parents, her sister, Helene, and even him.

A conversation with Helene, about Pillars of Life

ME
"I feel like everything around me is breaking down...my life is a house of cards."

"I want to be more resilient, you know what I mean? I want to feel more on top of things!"

HELENE
It's not all on you Alison! There are some strong pillars in your life!

Here are 3 Introspective avenues

PILLARS

Music Reflection
Listen to a playlist generated from the theme of this conversation.

Connect
Call your Dad and ask him about his support network when he was your age.

Visualise
Draw the pillars of your life and visualize the people that have influenced you.

3 Alison decides to continue unpacking the pillars of her life and calls her father.

Reflection
Several issues are bound up in this design proposal. Would users willingly cede autonomy to their Introspective AI, trusting it to extract and guide dialogue in the right way? Could the system curate content in ways that may be biased? Would this persistent, growing, and increasingly entangled archive of deep exchange records shape or change the initial ritual of simply deep talking with loved ones?

Discussion

Designing interactive systems to support experiences of self-introspection raises new possibilities and challenges. Current digital products are limited in their near-exclusive focus on facilitating introspective journaling, where AI is applied to organize and analyze entries; and by drawing only on data that end users explicitly provide them. Our pictorial inquires into how AI might operate as a context-aware mediator between users and aggregations of their personal data. We contribute five generative themes and seven design proposals that motivate and expand the Introspective AI design space. Next, we reflectively consider these design proposals to surface opportunities and questions to inspire future HCI and design research.

Understanding Starting Points & Dilemmas

Initiating introspective activities in intelligible and personal ways is essential to developing a relationship with an Introspective AI.

Everyday Personality and Music Reflection illustrate how brief, contextually relevant prompts might lead to introspective experiences. The combination of short prompts and occasional confrontations presents a technique that designers could mobilize to keep people self-aware of their future goals while building in the capacity to choose new paths for their future self. However, inferring when the *optimal* time is to surface positive patterns or negative discrepancies recognized by the AI will need to be handled carefully. There is a need for future HCI research to investigate where boundaries of social acceptability lie when an Introspective AI mediates and perhaps even disrupts a person's routines and behaviors.

Both proposals make use of the technique of balancing the novelty of a new AI technology with the familiarity of commonly used applications (e.g. messaging and music streaming) to support their initial adoption in ways that can scale to more sophisticated uses in the future (see [30,41]). This approach might be especially useful when laying out the grounds for designing a relationship between people and their Introspective AI model. This suggests a need for future research to investigate when, how, and in what form subsequent Introspective AI applications would arrive, as well as how consensus on these decisions could be made among a person and their Introspective AI counterpart.

Embracing Divergent Strategies

There will inevitably be inaccuracies in the Introspective AI model of a person as they accumulate life experiences over time. Our pictorial makes clear there is an opportunity for designers and researchers to explore how cycles of collabo-

ration and alignment can be facilitated productively among a person and their AI, in parallel with recent work calling for the HCI community to embrace the quality of uncertainty in human-AI relations as a design material (e.g., [7]).

Mind Probes materializes the shared labor bound up in long-term human-introspective AI relations by asking the end-user to collect personal data to improve the model. This approach demonstrates how designers can mobilize this technique of extending introspective practices to subtly prompt collaboration and alignment in inspiring and reciprocal ways.

Vision Shrine extends an established introspective technique through materializing tensions between desires of the current self and visions of the ideal self. While the decision-making processes are ambiguous, Vision Shrine behaves playfully, remaining open to change over time. This approach builds on the trajectory of research on ludic and reflective design [26,27,68]. Mobilizing such design strategies may offer a productive contrast to more active or direct forms of confrontation. Simultaneously, the social appropriateness of an AI model's behavior to actively protest a person's desire to depart from their envisioned ideal self—even if ludic or reflective on the surface—remains unclear. Can or should ludic design mitigate tensions? Which attitude might people prefer? These strategies and questions mark clear areas for future research to investigate.

Hello, Cyberself proposes a design strategy that enables a person to manipulate their Introspective AI directly. This technique could be used by designers when a user and their Introspective AI model drifts too far out of alignment and a hands-on approach is needed to resume the course. This also suggests a need for future research to investigate possible vulnerabilities that these kinds of direct manipulations could cause. Would this strategy nurture long-term relations even if they become fraught at certain points in time? Or, could it compromise a person's perceived authenticity and trustworthiness of the model?

Besides addressing imperfections that might emerge in human-introspective AI relations, these three design proposals also make clear that successfully fostering longer-term adoption will require designing in support for shifting levels of autonomy, trust, and vulnerability among people and their Introspective AI.

Leveraging Introspective Data from Diverse Contexts

Dream Streams and Deep Talk Report explore opportunities for incorporating personal data from different levels of perceptual awareness into novel shapes and forms to introspectively reflect on.

Dream Streams presents opportunities for mobilizing partially known, buried, or unknown subconscious behavior and associations into new introspective resources. Such resources would likely be unique and take time for people to interpret. From quantified themes across dreams to music playlists generated from post-dream reflections to more complex, dream-like visualizations, this proposal aims to inspire designers to explore different levels of abstractions when dealing with rich accounts of introspective resources.

Alternatively, Deep Talk Report preserves and enhances records of deep social exchanges as interactive resources. This approach suggests an opportunity for designers to generate more interpersonally-oriented Introspective AI applications that engage directly with the social relations that shape a person's current and future ideal self. Nevertheless, there is a need for future work to explore the extent to which divorcing these exchanges from their original context and reducing them to interconnected bits might alter their perceived value and lead to added social expectations.

These proposals collectively suggest opportunities for future research and practice to develop the Introspective AI design space by exploring social attitudes toward leveraging personal data collected from diverse contexts—from the conscious to the subconscious, from the casual to the intentional.

Conclusion

Our work offers contributions that extend growing calls in the HCI community to: (i) enable people to gain alternative perspectives on their life through personal data (e.g., [23,24,40,50,61,65,74]), (ii) critically explore AI as a design material (e.g., [7,32,42,43,46,47]), and (iii) inquire into potential technological futures and unpack their promise and peril (e.g., [3,15,18,60,72]). Our pictorial aims to inspire, frame, and expand future research inquiring into the questions: What roles could personal data play in helping us introspectively consider who we are and desire to be? How might AI play collaborative roles in this endeavor over time? What kinds of new opportunities and consequences exist in the Introspective AI design space, and how should we reconcile them?

Acknowledgements

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