

Snapping Out of It: How a Wearable for Self-Tracking Assisted Psychotherapy Bridges the Gap Between Thoughts and the World

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ABSTRACT

This case study explores the use of the One Button Tracker (OBT), a wearable self-tracking instrument, by a refugee diagnosed with complex PTSD, in personalized self-tracking assisted psychotherapy. The OBT differs from traditional mHealth methods, which typically rely on predefined tracking parameters, by empowering the patient to focus on their own subjective experiences of phenomena selected during treatment. This approach fosters patient-therapist collaboration, tailoring the therapeutic process to individual needs. Here, the patient chose to track flashbacks, a grounding intervention, and anger experiences. Findings reveal a multifaceted relationship between the patient and the instrument, underscoring the instrument's significance in supporting the therapeutic process. The patient's consistent engagement with the OBT, demonstrates its ability to bridge the gap between daily life and psychotherapy. This study underscores the relevance of integrating personalized self-tracking in therapy demonstrating that such instruments can serve multiple roles, from data collection to therapeutic companions in patients' lives.

CCS CONCEPTS

• Applied computing → Health informatics; • Human-centered computing → Ubiquitous and mobile devices; Haptic devices; Visualization.

KEYWORDS

Mental health, personalized self-tracking, One Button Tracker, wearables, psychotherapy

ACM Reference Format:

Lisa G. Riisager, Thomas B. Christiansen, Stine B. Moeller, Lotte Huniche, and Jakob E. Larsen. 2024. Snapping Out of It: How a Wearable for Self-Tracking Assisted Psychotherapy Bridges the Gap Between Thoughts and the World. In *Extended Abstracts of the CHI Conference on Human Factors in Computing Systems (CHI EA '24)*, May 11–16, 2024, Honolulu, HI, USA. ACM, New York, NY, USA, 7 pages. <https://doi.org/10.1145/3613905.3637112>

1 INTRODUCTION

The field of Mobile Health (mHealth) within digital mental health research has been predominantly focused on evaluating the clinical outcome of mobile and wearable technologies, marking a significant advance in digital mental health interventions. This approach often regards these technologies as already given solutions, primarily assessing their efficacy in addressing diverse mental health challenges. However, concentrating mainly on the technology itself and its outcome can lead to a limited understanding of technology's role within the therapeutic process [7]. Without understanding the mediating role of the technology in the patients' lives, we risk overlooking insights into its therapeutic potential and how it might be used to improve the clinical process. As Postman [8] noted, "A new medium does not add something; it changes everything."

This case study involves a refugee diagnosed with complex PTSD (CPTSD) using a wearable self-tracking instrument, the One Button Tracker (OBT), as part of her personalized self-tracking assisted psychotherapy. Whereas most self-tracking instruments come with predefined tracking options, the OBT supports patient-therapist collaboration on what subjectively experienced phenomena to track as part of the treatment. Framed within a postphenomenological theoretical framework inspired by the work of Ihde [4] and Verbeek [11], we explore how the patient integrates the self-tracking instrument into her daily life and how it influences her interactions with her world. Within this framework, we investigate two key aspects of the instrument's role: Firstly, we explore the concept of multistability, which highlights the instrument's various roles contingent upon the patient's intentions [1]. Secondly, we explore how the instrument *mediates* the patient's experiences, actively influencing and shaping her connection to the world [11, 12]. This mediated perception unfolds in two distinct forms: *embodiment relations*, where

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CHI EA '24, May 11–16, 2024, Honolulu, HI, USA

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ACM ISBN 979-8-4007-0331-7/24/05.

<https://doi.org/10.1145/3613905.3637112>

users seamlessly integrate technology into their lives, effectively channeling their intentions through it [1], and *hermeneutic relations*, where technology offers a world representation that necessitates interpretation [11, 12]. Lastly, we explore the patient's relation with the instrument itself, a concept conceptualized as the *alterity relation* [4, 11]. By using a postphenomenological perspective, we can illuminate the multifaceted transformation of perception introduced by a self-tracking instrument in psychotherapy for individuals with serious mental health conditions like CPTSD.

Through this study, we aim to contribute in three significant ways: (1) Illuminate the intricate relationship between self-tracking wearables and therapeutic modalities, an under-researched area in digital mental health. (2) Offer critical reflections to guide future research using wearable self-tracking instruments in clinical contexts. (3) Emphasize the importance of adopting a multilayered perspective on self-tracking technology for a comprehensive understanding of the user experience.

2 METHODOLOGY

This case study focuses on a patient engaged in personalized self-tracking assisted psychotherapy that integrated a self-tracking instrument. The study involves data from three sources: (1) self-tracking data, collected by the patient in daily living conditions between sessions. (2) Three interviews with the participating patient: One at treatment start, one midway, and a final interview at treatment end. (3) Logbook entries written by the therapist after each session, documenting session content, the use of self-tracking data, and clinical impressions.

The case study was conducted at the Clinic for Trauma and Torture Survivors (CTTS), Region of Southern Denmark, as part of a broader research project focused on developing a personalized self-tracking assisted psychotherapeutic treatment concept for refugees diagnosed with CPTSD. CTTS specializes in treating refugees and veterans with PTSD and CPTSD resulting from war, political oppression, and torture. Psychotherapy is conducted by psychologists and primarily follows cognitive behavioral therapy (CBT) and narrative exposure therapy (NET) (for more information see Riisager et al., in review [9]).

2.1 Participants

For this case study, a therapist and a patient were recruited. Patient eligibility criteria included psychiatric referral, refugee status, age 18 or older, and a CPTSD diagnosis based on The International Trauma Interview [10]. The therapist is an experienced clinical psychologist with 8 years of expertise in trauma treatment for refugees, primarily using 2nd and 3rd wave CBT approaches as well as NET. The patient, referred to as "Maria" for confidentiality, is a single mother in her early thirties, diagnosed with CPTSD at CTTS. Maria participated from December 2022 to May 2023, and was selected for this case study due to her completion of the treatment within the larger study. She has survived multiple traumas in her home country in Eastern Europe and during her approximately decade-long residency in Denmark. Despite complex family dynamics, Maria maintains a close family bond and limited social interactions beyond this circle. She is currently on sick leave.

2.2 Apparatus: One Button Tracker and Data Visualization Tool

The patient used our research prototype instrument, the One Button Tracker (OBT), to actively self-track observations she made of phenomena relevant to her mental health condition.



Figure 1: Examples of the One Button Tracker (OBT) as worn around the neck and on the wrist.

The OBT is designed with a set of specific user interface considerations in mind to support quick and simple user interaction and to minimize errors. The prototype OBT in this study had dimensions of 41×31×12.5 mm, and was designed for versatility in wearability: around the neck, in a pocket, or on the wrist (see Figure 1).

As the name suggests, the OBT has a single button, enabling the user to register phenomena in the closest possible temporal proximity to their occurrence. The button is indented in the surface of the casing to provide a distinct and tactile cue, thereby facilitating effortless user interaction. Also, the indentation of the button protects against being unintentionally activated. The design allows the user to operate the instrument in under a second, without requiring visual attention, thereby minimizing the potential for errors and distractions. Further, the physical design of the OBT makes it possible to discreetly conceal the instrument under clothing and press the button through the fabric — thereby preserving user privacy and agency over their self-tracking.

Upon pressing the button, the instrument provides strong vibrotactile feedback for the duration of the button press, confirming the registration of the time and duration. This tactile confirmation reduces the need for users to divert their attention from ongoing activities, unlike using apps which require screen focus and can lead to digital distractions [1]. Furthermore, the lack of a screen eliminates the requirement for users to visually engage with the instrument, enabling a non-distracting self-tracking process.

The OBT prototype used in the study has a maximum battery life of 4 weeks. Data is stored locally on the OBT and is transferred via a USB cable to a computer, thereby ensuring that the user stays in control of their data and can share it with the therapist of their own volition. Finally, the OBT offers fully automatic configuration, including automatic time setting via a built-in GPS chip, thereby avoiding the need for a manual error prone setup.

During therapy sessions, the therapist and patient used our research prototype web-based data visualization tool, which enables exploration of the OBT self-tracking data. The tool offers a calendar-like overview and visualizes observation distribution by day of the

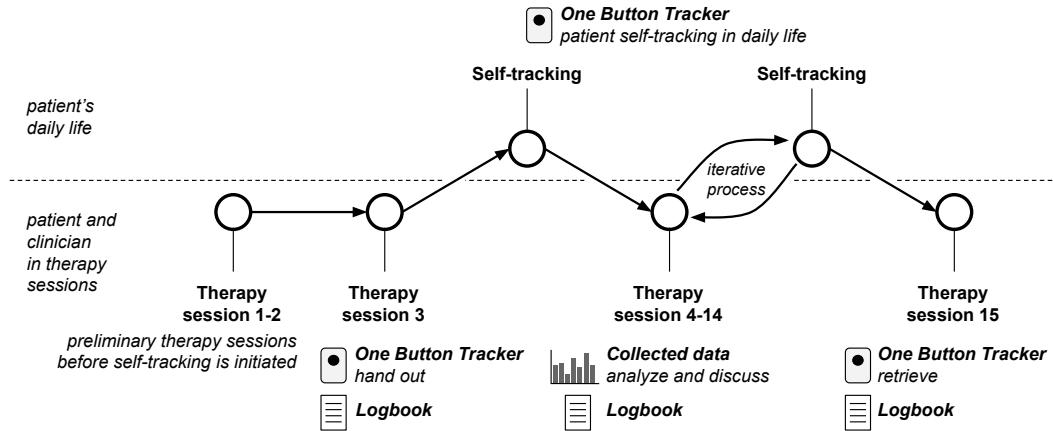


Figure 2: Flowchart of the self-tracking assisted psychotherapy process involving the patient self-tracking a defined target phenomenon in daily life using the One Button Tracker instrument. During therapy sessions the patient and clinician analyze and discuss the collected data to inform the psychotherapeutic process and target clinical interventions.

week and hour of the day. Example data visualizations from the tool are shown in Figures 3-5.

2.3 Procedure

The patient received 15 sessions of personalized self-tracking assisted psychotherapy. An overview of the therapeutic process is shown in Figure 2.

In the initial two sessions, the therapist provided psychoeducation about PTSD and outlined the treatment plan. The patient's specific concerns were identified, and a grounding intervention which the patient and therapist named "I'm here" was introduced. Simultaneously, personalized self-tracking assisted psychotherapy was introduced, emphasizing the OBT's role in gaining insights into daily mental health experiences. At session three, the therapist deemed that the patient was ready to initiate self-tracking and provided the OBT instrument. The personalized self-tracking assisted approach centers on the *target phenomenon* — a distinct experience, symptom, or behavior chosen by the patient in collaboration with the therapist for a highly personalized self-tracking experience. The target phenomenon is continually reviewed and updated guided by data insights, ensuring an adaptive therapeutic response. During Maria's treatment, several phenomena were tracked: 1) flashbacks, 2) the "I'm here" grounding intervention, and 3) moments of anger. The selection of these target phenomena was a collaborative decision between the patient and the therapist — and was not decided by the researchers.

To anticipate what the data expectedly would show, the therapist created a hypothesis list outlining assumptions about the target phenomenon and its dynamics. An observation protocol detailed tracking procedures, including criteria for making observations and execution of OBT button presses [9]. Here, the participant could define whether to track a single target phenomenon or two, thereby defining the observation protocol to be used (e.g. one press for phenomenon no. 1 and two presses for phenomenon no. 2). The therapist evaluated the observation protocol in the following session, considering the tracking period, overall tracking experience,

and the ability to distinguish the target phenomenon from other daily phenomena. Data analysis during therapy sessions helped identify patterns and discrepancies, informing clinical interventions.

2.4 Data analysis

All three interviews with the patient were conducted in Danish by first author LGR, who is a clinical psychologist, and lasted approximately 60 minutes. Interviews were transcribed verbatim and quotes provided in the findings section were translated from Danish to English by LGR. The first and more descriptive phase of the analysis followed the six phases of Braun & Clarke's reflexive thematic analysis: Familiarization, data coding, initial theme generation, reviewing themes, defining and naming themes, and finally, writing up the findings [2, 3]. The second and more interpretive phase of the analysis was informed by postphenomenology and the work of Ihde [4] and Verbeek [11] and was carried out by LGR supervised by co-authors LH, TBC, and JEL.

2.5 Ethics

The patient gave written and oral consent to participate in the study. The study was evaluated by The Regional Committees on Health Research Ethics for Southern Denmark (project-ID: S-20210019 CSF).

3 FINDINGS AND DISCUSSION

Maria wore the OBT around the neck for easy concealment of the instrument in social contexts. The therapist wrote 15 logbook entries, one for each of the psychotherapy sessions that Maria attended.

3.1 Self-tracking

An overview of Maria's self-tracking data is shown in Table 1. In total 1254 observations were made throughout the 92 day observation period (January 19 to April 20, 2023, both days included). Of

Table 1: Overview of the self-tracking data collected by the patient

Total number of sessions	Tracking started (session)	Duration (days)	Number of observations	Daily average observations	Days without observations
15	3	92	1254	13.6	1

those, 1233 registrations were 1 press and 20 registrations were 2 presses (an intervention). On one occasion Maria made 3 consecutive presses of the button, which may have been an attempt to make 2 presses, as 3 presses were not defined in the observation protocol.

Figure 3 provides an overview of all the observations made over all of the 92 days. The visualization should be interpreted like a condensed calendar with days on the x-axis and the y-axis showing the hour of the day. The gray background denotes weekends. In the plot blue dots represent a single press whereas orange dots represent 2 presses of the button. Maria was quite engaged and consistent in her self-tracking during the course of treatment, except for 6 days around the beginning of April where she made very few daily observations. An overview of the distribution of the observations made on days of the week is shown in Figure 4. On average Maria made between 11.6 and 15.9 observations per day of the week. The distribution of the observations made on hours of the day is shown in Figure 5 and it reveals that Maria made observations at all hours with the majority of observations made during the evening (hours 21-24) and during the night (hours 00-08). In comparison, considerably fewer observations were made in the morning and afternoon. This pattern was consistent throughout the course of treatment, as can be seen in Figure 3.

3.2 Interviews

The interviews highlight the patient's dynamic and multifaceted use of the OBT and the analysis identified three main themes: 1) An alterity relation: Interacting with a quasi-other 2) An embodiment relation: A technological extension of oneself 3) A hermeneutic relation: Data as a medium for therapeutic exposure.

3.2.1 An alterity relation: Interacting with a quasi-other. Maria consistently ascribes human qualities to the OBT, characterizing her connection with it as familial providing her with an outlet for anger, a way to seek solace, and maintain confidentiality regarding matters she believes her family had little interest in. In her narrative account, Maria personifies the OBT, suggesting an alterity relation with the instrument. Consequently, she does not regard it merely as a tool but as a quasi-other.

Interviewer: "So you hand over your embarrassment and anger?"

Maria: "Yes. When you're angry, you can do that. It feels like you're handing it over to someone else."

Maria's anger weighs heavily on her and frequently emerges when she becomes lost in her thoughts, where she describes a noticeable divide between her inner world and external reality. The therapist's logbook entries demonstrate that Maria uses the OBT to track her grounding intervention not only during flashbacks but also when she is ruminating – moments that often disconnect

her from the external reality. This distinction between her inner world and the external reality is a recurring theme across all three interviews, emphasizing Maria's perception of the OBT as a quasi-other, capable of bridging these two realms for her. In the final interview, Maria elaborates on her experience with tracking her grounding intervention:

Maria: "But when it captures you, it really grabs hold. It's tough... (...) I mean, it sucks you in. You can't just snap out of it. It's like when you're really sleepy and you try not to fall asleep. But you still end up falling asleep."

Interviewer: "Did it [the OBT] help you get out of these thoughts?"

Maria: "I would say it helps the moment when you press it. But you can slip back into your thoughts. But you start thinking when you're in there that there's something waiting for you. I mean, there's something that disrupts your thoughts (...). It's like a person knocking on the door, and you have to open it. It's exactly the same, you know. Because you have to press it, I have to remember it, you know."

Similar to forging a bond with another person or developing a therapeutic alliance with a therapist, Maria initially perceives her connection with the OBT as rather detached, viewing it as a simple technical tool aimed at providing some relief from her mental distress, as evident in her first interview. However, this relationship undergoes a significant transformation over time, evolving into a more personal and reciprocal connection. This transformation is particularly evident as Maria describes the profound impact of her nighttime experiences, where she feels trapped in her inner world, continually reliving traumatic events. It is during these moments that the OBT assumes the role as a quasi-other, aiding her in regaining presence in the world. In her final interview, Maria not only emphasizes her personal friendship with the OBT but also the varying intensity of this connection, particularly at night, where she feels the strongest connection.

Maria: "(...) I didn't understand it at first. But over time, being here, knowing you have something waiting for you. Or you express your anger like, tzzzt [pressing the button]. I don't know why I do it that way, but that's how I do it. You know, come and take it [her anger] from me. Not that it makes the biggest difference in the world, but it does make a small difference in your life."

What is particularly remarkable in this relational transformation is that the OBT itself remained unchanged throughout the therapy; it is Maria's perception and the derived benefits from the instrument that evolve.

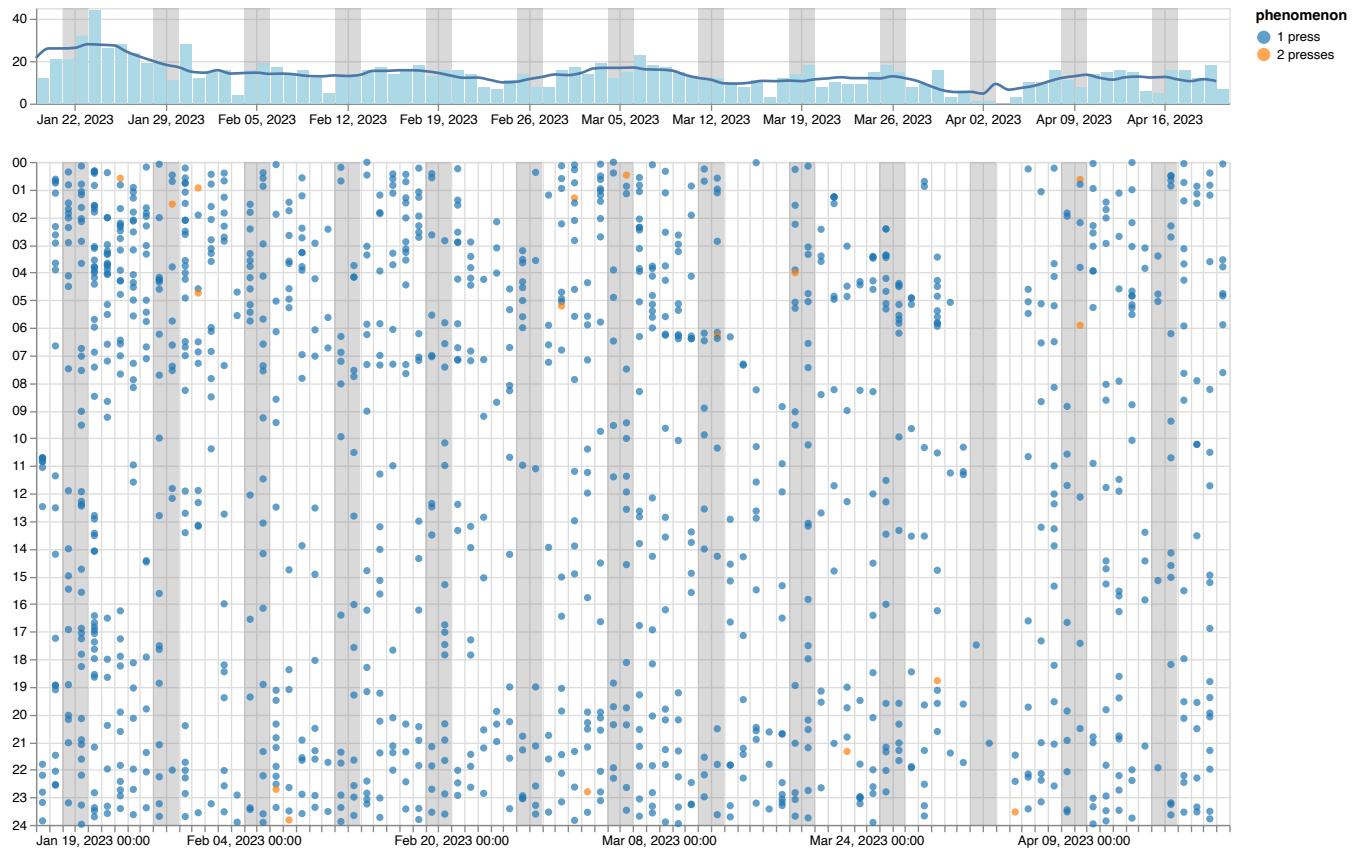


Figure 3: Calendar overview of all the observations made over the 92 days. Days are shown on the x-axis (gray background denoting weekends) and the y-axis shows the hour of the day. Blue dots represent a single press and orange dots represent 2 button presses.

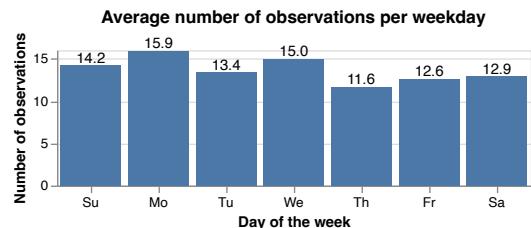


Figure 4: Distribution of the observations made on days of the week.

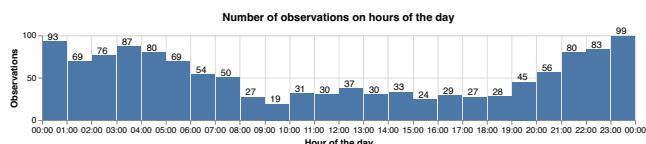


Figure 5: Distribution of the observations made on hours of the day.

3.2.2 An embodiment relation: A technological extension of oneself. Parallel to Maria's evolving relationship with the OBT, her perception of the instrument also changes. Initially, she views herself as working for the instrument, but gradually, she begins to experience it as an active participant working for her benefit, thereby attributing the instrument a degree of agency within her treatment. Here, her relationship with the OBT is embodied as it reshapes her way of being in the world. This shift in her relation with the OBT is reflected in the interactive dynamics between them, characterized by Maria's button presses and the consequent vibro-tactile feedback from the OBT. These interactions momentarily give Maria a sense of agency over her flashbacks and ruminations. In response to a question about the OBT's impact on her, Maria responds:

Maria: "It's the vibration [from the OBT]. (...) The vibration, and also because I know I have to press it. The awareness that something awaits me. So, it possesses numerous positive qualities. I mean, it awakens someone, befriends you, and absorbs, as you might say, your negative experiences. But it's not so much about what's occurring in the external reality. It's more about what's happening within here [referring to her mind]."

The vibro-tactile feedback from the OBT upon button-presses plays a central role to Maria's profound dynamic and responsive connection with the instrument. During the first interview, Maria describes her avoidance of physical contact with others, including family members, following a traumatic event six years ago. However, in her relationship with the OBT, physical interaction seems to offer depth and meaning. Using Ihde's [11] concepts of micro- and macroperception, the vibro-tactile feedback, a microperception, allows Maria to interpret these vibrations, a macroperception, as means of bringing her back or managing her anger. This vibro-tactile feedback mirrors her emotions by responding in duration to the length of her button presses, much like the attentive response one would experience from a therapist in a therapy session. In the following excerpt from Maria's second interview, she elaborates on how the vibro-tactile feedback from the OBT gives her a sense of agency when caught in her inner world:

Interviewer: "And when you say it wakes you up, what is it that it does?"

Maria: "Yes, so, I am, as you see me, I am here, but I can also be lost in my thoughts. But if I go and press it, it vibrates your fingers, but it feels like it vibrates your entire body, where you tell yourself, come on, wake up. When you press it, it gives you a little extra push, you could say. It seems somehow to awaken you from your thoughts."

Through Maria's interviews and interaction with the OBT, we observe a dynamic interplay in which certain aspects take precedence while others recede into the background. She demonstrates a distinct awareness of her intentions when pressing the button and the specific phenomena she aims to track, illustrating the multistability of the instrument [5]. Her intentions for engaging in tracking creates variations in her interactions with the instrument and influence her perception of its function. When tracking her anger, she describes the act as "handing over her anger," while in moments when she feels trapped in her inner world, her goal is for the instrument to "bring her back" by tracking the grounding intervention. During the interviews, Maria elaborates on the sensory distinction in her engagement with the OBT while tracking different phenomena:

Maria: "Yes, the anger, that's a firmer press. I mean, I really grip onto it. I press it a bit harder (...) As for the other one [the grounding intervention], it tells me that there's something waiting for me. And I need to get out of there."

Maria's personal connection with the OBT is further emphasized by her expression of a profound void she experiences after returning the OBT. It is as though an extension of herself has been taken away, leaving her feeling unprepared to manage her anger and rumination. Drawing from Merleau-Ponty's phenomenology [6], repeated actions can be embedded so deeply within us that they function almost reflexively, outside of conscious control. The habit formation that had taken place in Maria's use of the OBT means that it became a natural and unconscious part of her daily routine, as evidenced when she says:

Maria: "But sometimes, I wake up without even realizing it, because I'm holding onto it (...) without

knowing why. I just find myself holding onto it so tightly, thinking, 'I have it.'"

Her instinctual bond with the OBT, especially during nighttime, underscores how deeply integrated the instrument had become in her lived experience, where the relationship can both be a quasi-other and an embodied relation depending on the context.

3.2.3 A hermeneutic relation: Data as a medium for therapeutic exposure. For Maria, the OBT was a mediator bridging her subjective experiences and their objective representations. The data assumes a hermeneutic relation [4], providing Maria's therapist access to her world for in-depth analysis and provided conversational support for both during therapy sessions. The visualized self-tracking data (see Figures 3-5) provided by the OBT offers glimpses into specific moments within Maria's daily life, creating a connection between her perceived mental health and the objective representation through her data.

Maria's relationship with the OBT transforms upon entering the therapy session. In her daily life, the OBT is embodied and somewhat transparent in its use. However, in therapy, it transforms into a hermeneutic relation, where the visualized data becomes a representation of her mental health status that requires interpretation. This shift might explain Maria's genuine surprise when confronted with her visualized self-tracking data, especially in the context of her nighttime experiences.

Maria: "You don't anticipate pressing it much. Not at all. You believe, 'I definitely haven't pressed it much.' Sometimes, I can't even believe I pressed it when... And then you realize, 'Last week, for sure – every time I returned [to therapy] – I didn't press it,' and suddenly, all those button presses showed up. I start to wonder, 'Did I really press it that often? I can hardly believe it.'"

Maria's response to the visualized self-tracking data highlights the inherent multistability of both the self-tracking data and the OBT. On one hand, it serves as a reliable reference, compensating for her memory issues. However, on the other hand, it forces her to confront her nighttime experiences, including the frequency of flashbacks and rumination, aspects she had not fully acknowledged. This presents a significant challenge for Maria, leading her to avoid engaging with the visualized data, a behavior often seen in exposure therapy. While avoidance may offer short-term relief, therapeutic interventions like CBT and NET aim to help individuals address avoided inner phenomena safely and systematically, reducing long-term dysfunction or suffering. Interestingly, this unintended exposure situation from seeing the visualized data went unnoticed by the therapist, allowing Maria to avoid the analysis of her nighttime experiences during therapy sessions. This oversight of the avoidance response may be due to the therapist being fairly new in the process of analyzing such self-tracking data during therapy sessions or that she was simply focusing on other aspects of the treatment.

Maria's interpretation of the data significantly influences her overall mental health experience. As she tracks two distress-related phenomena, days with only a few data points become indicators of improved mental health, closely associated with feeling healthier.

Conversely, during days marked by apathy, data points are absent, reflecting her resistance to using the instrument.

4 LIMITATIONS

The insights from this case study is derived from a single case within a specific clinical setting. Maria's experiences are influenced by individual factors like age and tech proficiency, and may not translate to other participants, necessitating cautious interpretation and application of the findings. The therapist, trained 2nd and 3rd wave CBT, used the self-tracking data and OBT in a manner influenced by this specific therapeutic orientation; different methodologies might have shaped the use of the data and the instrument differently. As the OBT instrument and visualization tool employed in this study are research prototypes, further clinical use of them could help identify opportunities for improvements to achieve deeper clinical relevance and integration into people's everyday lives.

5 LESSONS AND PERSPECTIVES

Our case study challenges prevailing views of self-tracking instruments and their potential role in psychotherapy. Maria's profound engagement with the OBT as a tangible object, rather than merely a data collector, should prompt the embrace of a more multilayered approach in analyzing these tools. A lesson learned from the case study is to consider both the quantitative data they generate and the user's relationship with the instrument and ways of engaging. This perspective calls for a shift away from solely focusing on data collection and towards recognizing self-tracking tools as active mediators in therapy, too. By acknowledging these instruments as mediators, researchers and designers can explore diverse interface modalities beyond traditional apps. This expansion broadens the understanding of the multitable roles of self-tracking instruments in psychotherapy, offering a deeper understanding of patient interactions. Consequently, we gain a more comprehensive insight into patient interactions with these systems and the significance patients attribute to them during treatment.

Another lesson learned from our study is that the OBT served multiple purposes for Maria, adapting to her intentions. Notably, her consistent engagement with the instrument throughout the course of treatment underscores its significance surpassing mere data collection. It evolved from a tool to a comforting companion and an embodiment relation, highlighting its multifaceted therapeutic role. The sustained active self-tracking demonstrates that even a minimal interaction, like a button press and vibro-tactile feedback, can provide a rich and meaningful user experience. The OBT stands out by eliminating digital distractions and offering transparency, fostering an embodied relationship with the user. This approach differs significantly from conventional patient monitoring where predefined parameters dictate what patients track. Instead, it places emphasis on the subjective user experience, enabling patients to determine in a collaborative process what matters to them to track. This suggests possible directions for design of future self-tracking instruments and methodologies. While the OBT in its current prototype version has a somewhat crude physical appearance and design—that could obviously be improved—we find it quite remarkable that it worked this well for the patient.

ACKNOWLEDGMENTS

These materials have received financial support from The Danish Victims Fund (grant no.: 20-610-00094). The execution, content, and results of the materials are the sole responsibility of the authors. The analysis and viewpoints that have been made evident from the materials belong to the authors and do not necessarily reflect the views of The Council of The Danish Victims Fund. The authors would like to thank the patient and therapist for their participation in the study and Jesper Aagaard for his valuable comments to the article.

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