

# Design of Digital Mediation Tool for Self-disclosing PTSD

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**Abstract.** Establishing trust is an important aspect of the design of technological tools for mental health, as individuals are persuaded to disclose personal distressing experiences when privacy is ensured. This work-in-progress paper presents an interdisciplinary research project aiming to compare the behavior of individuals expressing trauma-related thoughts and feelings in response to trauma-evoking video clips, following three different interaction sources: a) a psychologist, b) a technological tool utilizing a human-like agent and c) a technological tool utilizing a machine-like agent. Electro-physiological, subjective and behavioral measures will be collected and triangulated to test the effectiveness of each interaction source. The design of the digital interface is presented in this paper aiming to provide insights for establishing trust in eHealth applications.

**Keywords:** Human Computer Interaction · eHealth · Privacy · Trust

## 1 Introduction

When individuals encounter extreme emotional distress, their physical and mental health strongly depends on the resilience to overcome the trauma. Exposure to traumatic experiences may result in Posttraumatic Stress Disorder (PTSD), a severe psychiatric disease that, according to the American National Center for PTSD [1], affects about 8 million adults and 5.5 million children in the U.S.A during a given year.

PTSD presents a low rate of detection [1]. Stigma of having a mental disorder acts as a barrier to self-disclosing experiences, the primary step into seeking treatment and recovering from the disease. Research [2] has demonstrated that individuals are more willing to report traumatic experiences and symptoms associated to PTSD when anonymity is ensured during mental health screening processes.

In recent years, a growing interest in digital interventions for mental health has been observed, yet only a few studies have been conducted on the effects of digital interactions on PTSD and its effective treatment through technological tools [3]. Emphasis has been given to the lack of technological tools that enable rapid intervention, even though

digital interventions, such as interference with visual-spatial tasks [4], have demonstrated a reduction of the number of associated symptoms.

Currently, no anonymous technological tools for disclosing PTSD exist and translation of face-to-face treatments into digital interventions remains a challenge [3]. As such, this project aims to design privacy-oriented mediation technologies for connecting psychological experts to PTSD patients through an interdisciplinary collaboration between computer scientists and psychologists.

To nudge individuals suffering from PTSD into disclosing sensitive information, a suitable trust channel needs to be established between the individual and the digital device. Since trust is a very complex social phenomena, the relation between design and trust in the eHealth domain has rarely been investigated [5]. Thus, this project also aims to identify mechanisms that establish trust-by-design in the PTSD disclosure scenario.

This ongoing research project will contribute into the field of psychotechnology by answering two main research questions. Firstly, *how anonymous digital interventions affect the emotional expression of trauma-related thoughts and feelings, and hence the disclosure of personal distressing experiences* (RQ1). Secondly, *whether individuals are more inclined to trust and therefore, disclose distressing experiences when the interaction with the computer technologies is performed by either a human-like or a machine-like agent* (RQ2).

This paper presents the general framework of the ongoing project and focuses specifically on the design of the technological tool in the PTSD context. Thus, it can be regarded relevant to the HCI and eHealth community.

## 2 Literature Review

Recent studies in human-computer interaction (HCI) [6, 7] have demonstrated that digital devices are perceived to be more confidential and trustworthy, and as such people tend to trust them more when self-disclosing information as compared to face-to-face or paper-and-pencil counterparts. The identified reasons on why humans trust machines more are as follows: performance of tasks with greater precision, objectivity of the machines, lack of verbal and nonverbal judgement, criticism or reaction [6, 8].

Surveys and observations conducted to compare virtual agents and humans reveal that individuals reported lower fears of self-disclosure, lower impression management and higher rates of sadness expression [9] when interacting through a digital device. Moreover, they expressed a relief of personal discomfort and alleviation of negative emotions, such as embarrassment, guilt, or anxiety [8].

Preference to disclose to a digital device has been demonstrated in the case of eliciting sensitive information in health and mental context [8]. Assurance of privacy, protection of personal information and anonymity [7] were the key factors reported by participants for why they prefer to self-disclose sensitive data to a digital device.

Individuals can establish trust [10] by developing a relationship with: 1. the entity that provides the service through the digital interfaces, and 2. the people handling the collected information. The trustworthiness conveyed by the interface can be achieved through design rules (pastel colors, effective clipart, balanced layout) [10], while trust with people handling the collective information can be enforced through security mechanisms that ensure the privacy of the users [11].

### 3 Methodology

Healthy participants will be recruited for this research study, rather than individuals diagnosed with PTSD, to avoid the risk of reactivating trauma in vulnerable subjects. Participants will be exposed to moderately distressing movie clips following the protocol of the trauma film paradigm [4]. This method is frequently utilized in clinical psychology to conduct clinical trials. It does not induce real trauma, yet it induces intrusive, but ephemeral, memories similar to PTSD during the days following the experimental session.

A between-subject experiment [12] will be conducted to test the hypothesis that anonymity and interaction with machine-like agents will affect the establishment of trust and hence the disclosure of traumatic experiences. After being exposed to the distressing movie, participants will be randomly assigned to one of the three treatment groups (presented below) or the control group (no interaction), which will act as a baseline for investigating the benefits of anonymity and machine-like agents as a facilitation:

1. Non-anonymous face-to-face interaction with a human mediator (psychologist)
2. Anonymous digital interaction with a human-like mediator (human-agent)
3. Anonymous digital interaction with a machine-like mediator (machine-agent).

The experiment will be conducted in the span of three months with 104 participants in total. The procedure will be initiated by exposing participants to the distressing movie, and then randomly assigning 26 participants in each group. The anonymous vs non-anonymous, and the human- vs machine-agent interactions will be compared, and insights regarding the benefits of each intervention will be provided.

Participants assigned to the first treatment group will share their distressing experience through interacting with a psychologist in a structured face-to-face interview. Participants assigned to the second and third treatment group will share their distressing experience through interaction with a technological tool utilizing a human- and a machine-agent respectively. All three conditions will follow a similar protocol, which bears on the effectiveness of the expressive writing method [13], a method that has proven effective in recovering from traumatic experiences.

### 4 Measurements

Throughout the duration of the study, three types of measurements will be performed in order to investigate the rate of self-disclosure following each of the three types of intervention.

Firstly, participants will be asked to self-report on their perception of privacy, willingness to share sensitive information to the technological interface and trust level on the design of the technological tool (if applicable). A series of Likert-scale questions will be asked to the participants at the end of each experimental trial and quantitative analyses will be performed to compare the effect of the experimental conditions on the recurrence and effect of traumatic memories of the participants.

Secondly, the actual reactions of the participants will be measured through qualitative analysis performed by the psychologists of the team on the information disclosed during each intervention session.

Thirdly, all subjects will be equipped with sensors measuring electro-physiological data such as: skin conductivity and heart beat rate during the intervention. Skin conductivity will be measured in SCR/min (Skin Conductance Responses per minute) using the Mindfield eSense Skin Response<sup>1</sup> sensors and heart beat rate will be measured in BPM (beats per minute) using an Apple Watch<sup>2</sup> series 4 device. Psychophysiology will be also utilized to analyze precisely the physical and emotional variations of the participants and investigate how they might affect the self-disclosure process.

Data collected through the various types of measurements will be compared and triangulated to identify patterns of emotional disclosure precisely and increase the validity of the results.

Finally, to protect the privacy of the participants, data will be stored anonymously in the RedCap<sup>3</sup> database, a secure web application that enforces the integrity of clinical data. An instance of RedCap is installed and administered on the local servers of EPFL in Switzerland, an infrastructure design decision that might impact the establishment of trust between the participants and people handling the information.

## 5 Technological Tool Design

As described in the Methodology section, participants of two treatment groups will be subject to anonymous digital intervention after watching the distressing movie clip. The content asked in each experimental condition will follow a standard set of questions defined by the psychologists of the team, however, the source of interaction will differ:

1. In the human-agent scenario, questions regarding the distressing experience will be asked through a video recording of the clinical psychologist of the research team (**Fig. 1 - left**).
2. In the machine-agent scenario, a text-bot named HealthBot will be introduced to ask the identical questions as in the first scenario (**Fig. 1 - right**).

Participants will disclose their trauma-related thoughts and feelings by anonymously typing in a textbox. Touchscreen and keyboard will be the modalities utilized for the human-computer communication. As emoticons have indicated to be a valuable addition to communication methods [14], the set of eight basic emotions defined by Plutchik [15] and the corresponding emoticons has been adopted. The panel for selecting emotions is always visible in the screen to aid emotional expression of the participants.

Digital interaction will be carried out through a tablet, as they provide increased usability (increased screen size, better readability) compared to smartphones. However, increased usability is considered a drawback to security and privacy [16], because the screen can be easily seen by bystanders from different distances and angles. In the current context, participants will be located alone in the physical space, thus, the drawback is not relevant. At the end of the project however, a mobile app will be additionally implemented to ensure privacy and security of all PTSD patients intending to use the technological tool in their daily life.

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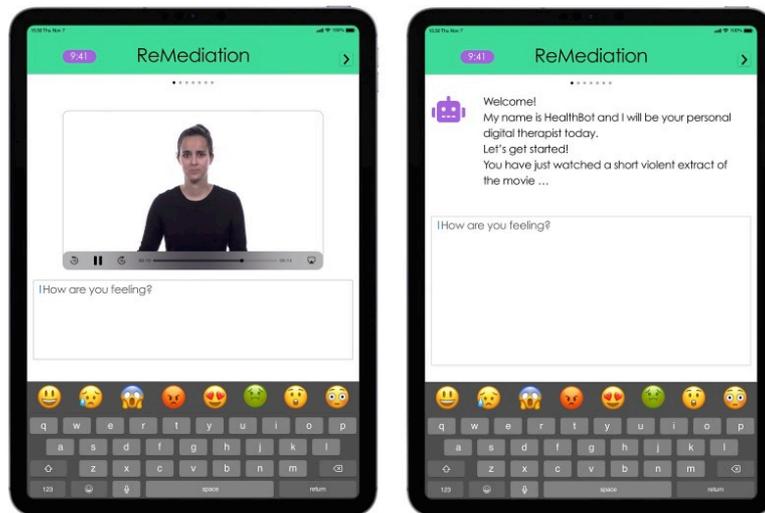
<sup>1</sup> <https://mindfield-esense.com/esense-skin-response/>

<sup>2</sup> <https://www.apple.com/chde/apple-watch-series-4/>

<sup>3</sup> <https://projectredcap.org/>

To assure the anonymity of the participants, users will be prompted at the beginning of the experiment that no meta data will be collected, solely the data voluntarily typed by the participant. Participants will not be required to log in and no personal info will be requested by the user interface (UI) at any point during the interaction.

The color scheme of the UI is composed of two complementary pastel colors: green and purple. The strong visual contrast of this dichromatic color scheme conveys balance, harmony and color richness, and ensures accessibility for individuals with color vision deficiencies.



**Fig. 1.** Design of the UI of the mediation tool utilizing a *human-agent* (left) and a *machine-agent* (right)

The design of the technological tools was developed in collaboration with the psychologists of the team, following guidelines found in the psychological literature regarding methods to render self-disclosure effective. After undertaking a pilot test to identify the best suited video clip to use for generating transient traumatic memories, the “Irreversible” movie was selected. The study will be carried out in the following months and, after being validated, it will be adopted to implement the UI of the mobile application that will be distributed to the open public.

## 6 Conclusions

This project focuses on designing technological tools for patients with PTSD that mediate the disclosure of traumatic experiences. The hypothesis is that anonymous digital interventions may encourage the emotional-expression of trauma-related thoughts and feelings, thus, resulting into more effective disclosure of distressing experiences. Furthermore, another key assumption is that the design of the technological tool will affect the trust building process and the interaction between the individuals and the technological tool, with individuals being more inclined to self-disclose to a digital agent that

resembles a machine than to a real human being. The final goal of the project is to deliver an effective technological tool with a user-centric design to PTSD patients to help them overcome trauma. Ultimately the project aims to provide research insights to the HCI and eHealth domains.

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