

The Effect of Multi-Sensory Physical Experiences in Daily Emotional Self-Tracking Service for Emotion Self-Awareness

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ABSTRACT

This study explores how physical interaction influences reminiscing by creating a system consisting of a physically interactive product and a digital app that visualizes collected data. It compares their effectiveness with mood trackers lacking physical elements. Reflection enhances social connections, strengthens family ties, and improves mental health. Though diaries aid emotion regulation, modern users prefer the convenience of mood-tracking apps. The study suggests that incorporating physical interaction enriches the reminiscence experience. It introduces “Reblower,” inspired by Korean hand air blowers, which activates through handle-turning, allows users to place emotion-representative objects inside, and visualizes input via a mobile app. User surveys indicate that memories linked to physical interaction are more impactful. This research aims to guide future reflective product designs.

Keywords: Daily emotion checks, Multi-sensory physical experience, Tangible product

INTRODUCTION

A recent study of 29 countries found that half of the population experiences at least one mental illness in their lifetime, with depression being the most common (McGrath et al., 2023). However, many people tend to avoid seeking treatment. But even without necessarily receiving professional treatment, efforts to observe oneself and try to make changes can help with depression. Among these methods, emotional regulation and emotional self-awareness are also positive factors (Demichelis et al., 2023; Suveg et al., 2009).

Emotional self-awareness (ESA) involves identifying and understanding one’s emotions (Lane & Schwartz, 1987). ESA positively impacts mental health, alleviates depression, and includes emotion regulation, which is crucial for life goals (Bakker et al., 2016; Suveg et al., 2009). Self-monitoring enhances ESA by tracking various aspects of life, including emotions and mood (Lupton, 2016; Feng et al., 2021). Mood tracking, often done via mobile apps, improves self-awareness, self-reflection, and emotion regulation by linking emotions to other factors like diet and sleep. Prior research suggests multi-sensory elements enhance user experience (Campenhout et al., 2013)

and body movement aids emotion regulation (Long et al., 2021; Reimann et al., 2012). This study explores how multi-sensory experiences can amplify mood tracking benefits.

LITERATURE STUDY

Emotional Self-Awareness (ESA)

Emotional awareness, a component of emotional intelligence (Salovey & Mayer, 1989), is the ability to recognize, understand, and express one's own and others' emotions (Lane & Schwartz, 1987). It involves identifying emotions, understanding their causes and effects, and regulating them adaptively. This is important for mental health and well-being. Emotional self-awareness (ESA) plays a key role in enhancing emotional intelligence and achieving social and emotional success. ESA is crucial for mental well-being, as it enhances emotional self-regulation (Barrett et al., 2001). Low ESA is linked to anxiety and depression, so improving ESA can help alleviate symptoms (Bakker & Rickard, 2018; Suveg et al., 2009).

Self-tracking improves mental health by increasing ESA (Kauer et al., 2012; O'Toole et al., 2014) and is effective in addressing anxiety, depression, and PTSD (Basoglu et al., 1992; Jarrett & Nelson, 1987; Ehlers et al., 2003). Apps using self-monitoring have been shown to boost ESA and reduce depressive symptoms (Morris et al., 2010; Kauer et al., 2012).

Mobile Mood Tracking Application

Self-tracking in mental health involves monitoring symptoms or general emotional states (Schueller et al., 2021). Mobile mood tracking apps typically allow users to select emojis, words, or freely describe their mood.

Mood tracking supports emotional health, aiding conditions like bipolar disorder and depression (Nicholas et al., 2015). It enhances self-awareness and emotion regulation (Church et al., 2010; Gay et al., 2011).

Emotion Regulation

Self-tracking can improve emotional awareness, which assists individuals in regulating their emotions and being aware of one's own emotional states, and may reduce emotional activation by observing brain activity (Herwig et al., 2010).

Emotion regulation is an attempt to influence when certain emotions are experienced by an individual and how these emotions are experienced and expressed (Gross et al., 2007). Emotion regulation involves (a) awareness and understanding of emotions, (b) acceptance of emotions, (c) the ability to control impulsive behavior and act on desired goals when experiencing negative emotions, and (d) the ability to use contextually appropriate emotion regulation strategies to modulate emotional responses to meet personal goals and situational needs (Gratz & Roemer, 2004).

Multi-Sensory Physical Experiences

Physical Interaction

Physical interaction involves using objects, gestures, and movements to engage with digital systems, enhancing user experience by combining physical

and digital elements (Campenhout et al., 2013). This includes controls like buttons, sliders, and sensors that translate physical actions into digital commands. Products incorporating physical interaction tend to be more user-friendly, while digital-only applications may hinder engagement and usability.

Physical movement can also regulate emotions (Reimann, 2012), supported by research showing the link between body movement and emotional recall (Xu et al., 2017). Devices that facilitate physical interaction can help users relive memories and enhance engagement. For example, Tsai et al. (2014) found that digital images with physical materiality improve memory recall, and Petrelli et al. (2010) showed that FM radios, through auditory stimuli, fostered family interaction and easier access to past experiences.

Multi-Sensory Experience

Interaction involves mutual influence, while experience results from observation and engagement (Oxford Dictionary, 2023). Product experience refers to psychological effects triggered by interaction (Hekkert & Schifferstein, 2007). Enhancing multi-sensory experiences strengthens user engagement (Lashkova et al., 2020) and facilitates richer product interactions (Schifferstein, 2011).

METHOD

Experimental Design

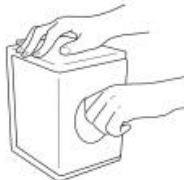
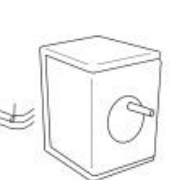
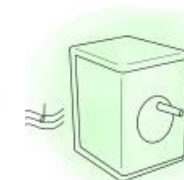
This study examines the use and impact of Reblower, a multi-sensory emotion-tracking device. The experiment used an online survey with the Experimental Vignette Method (EVM) to minimize external influences. Participants with prior experience using emotion-tracking apps watched a video demonstrating Reblower, imagined using it, and provided subjective responses before and after the experience.

Experimental Materials

Physical Prototype

Reblower is designed for emotion tracking in research, visually expressing emotions through colored lights. It features a reminder function that blinks lights at a set time to prompt users to record their emotions. When an emotional object is inserted, the objects-matching lighting changes color accordingly. Additionally, it plays ASMR trigger sounds to enhance immersion. Lastly, Reblower transmits emotional data to a mobile app for tracking and management. Reblower provides a multi-sensory experience through four key elements: 1) handle rotation (touch), 2) wood-burning sound during operation (hearing), 3) emotional object selection (touch, sight), and 4) light color change based on the object (sight) (see Table 1).

Table 1: Multi-sensory physical experience provided by Reblower.

			
1) Handle Rotation (touch)	2) Wood-Burning Sound (hearing)	3) Emotional Object Selection (touch, Sight)	4) Light Color Change Based on the Object (sight)

Emotional Objects

Emotional objects are key to using Reblower. These objects, which represent six basic emotions (anger, surprise, anxiety, disgust, happiness, and sadness) as defined by Ekman & Oster (1979), allow users to record emotions in the Reblower app. Research indicates that fewer choices lead to more efficient decisions (Torkamaan & Ziegler, 2020).

A workshop with four design graduate students aimed to enhance the empathy of these emotional objects. Participants were first introduced to sculptures expressing emotions (Isbister et al., 2006) and the six basic emotions. They then created objects reflecting these emotions and explained the reason behind their designs. The shapes and colors selected for each emotion were: red for anger, yellow for surprise, purple for disgust, indigo for anxiety, blue for sadness, and green for happiness. Insights from the workshop were analyzed using the affinity diagram method and discussed with additional design students. Table 2 shows the selected shapes and colors.

Table 2: Sample human systems integration test parameters (Folds et al., 2008).

Type of Emotion	Photo	Type of Emotion	Photo
Afraid (Choking and twisted, or pinched)		Disgust (Non-formal, with many protruding and twisted in parts)	
Angry (Sea urchin shape - pointy tips spreading from the center)		Surprised (Disrupted and irregular shape)	
Happiness (Curved, smooth, simple outline, gentle partially protruding or compressed)		Sadness (Slightly curved, but not rounded or twisted)	

Video Vignette

The Experimental Vignette Method (EVM) is a research approach using vignettes to simulate user experiences. A vignette is 'a brief description combining features of a person, object, or situation' (Atzmüller & Steiner, 2010). EVM is useful for testing products or systems that are difficult to implement due to technical or institutional constraints (Ringfort-Felner et al., 2022). It has been used to assess how people perceive events in virtual environments (Tromp & Hekkert, 2016) and is effective when experiments are hard to control or generalize (Aguinis & Bradley, 2014).

Given that daily emotion decisions can be unclear and influenced by various factors, EVM was chosen to gain meaningful results. Emotions can be significantly impacted by everyday elements like text messages or videos. To understand Reblower's impact on emotions, participants were asked to imagine using the device and record emotional changes through vignettes.

Since everyday emotion decisions can be unclear, EVM was chosen to obtain meaningful results. Various life elements, like text messages or video clips, can significantly impact emotions. To understand Reblower's effect, the survey asked participants to imagine using it and record emotional changes through video vignette. Initially, a third-person perspective video introduced Reblower, followed by a first-person perspective video to enhance immersion.

The third-person perspective video shows the Reblower in use: at the set time, its light flashes, prompting the user to turn the handle to activate it. They select an emotional object, place it inside, and the light changes to match the object's color. The data is sent to a mobile app, and a notification confirms completion. After that, the user sees glowing lights and hears firewood burning. The first-person perspective video captures the user's experience of daily emotional self-tracking (DEST), beginning with the blinking light notification, followed by activating Reblower, selecting an emotional object, and reflecting on their emotions while immersed in the soothing sensory elements. There are two screenshot images from the third- and first-person perspective video for example (Figure 1).



Figure 1: Screenshots of the third-person perspective (right) and of the first-person perspective (left).

Measurement Tools - Positive and Negative Affect Schedule (PANAS)

To measure the experiment, we used The Positive and Negative Affect Schedule (PANAS). PANAS consists of 20 items that measure positive affect (PA) and negative affect (NA), and each emotion is rated on a five-point scale (Watson, Clark & Tellegen, 1988). The PANAS consists of 10 items for each

PA (e.g., interest, enthusiasm) and NA (e.g., anxiety, distress), with each total score range of 10 to 60.

In this study, the PANAS was used to analyze changes in emotions before and after using Reblower. Participants were asked to rate their emotions before and after watching a video of a Reblower to investigate whether their emotions changed.

Online Survey

During the experiment, participants completed five surveys to assess their experience with Reblower, ESA, and emotional changes. Each survey measured the experience of using Reblower as an emotion tracking tool.

In the first survey, participants were introduced to the experiment, and their emotional state was assessed using the PANAS. They then learned to use Reblower and recorded their Daily Emotional Self-Tracking (DEST) experience with Reblower, followed by a PANAS survey to measure emotional changes before and after use.

Surveys two to five followed the same procedure: participants assessed their emotional state with PANAS, recorded their DEST experience imagining the use of Reblower, and completed PANAS again to track emotional changes.

Sample and Procedure

This experiment involved participants familiar with the app to compare Reblower with existing mobile emotion tracking applications. Participants, aged in their 20s and 30s, were recruited voluntarily and through direct requests, resulting in data from six men and 13 women (average age: men 25.6, women 25.5 and overall 24.2). Over 10 days, they recorded their emotional state nightly at 9 p.m. via a survey link sent by text. The experiment was completed on a computer, and participants who finished all surveys were rewarded.

RESULTS

Positive and Negative Affect Schedule (PANAS) Score Change

The average PANAS score generally increased after using Reblower (Figure 2), suggesting a positive emotional impact.

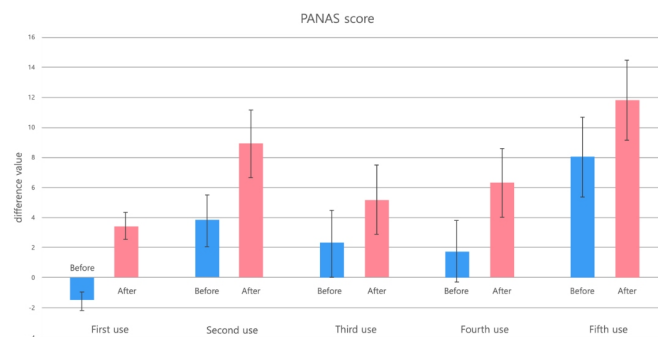


Figure 2: PANAS score average for each time of use (1st time ~ 5th time).

Multisensory Physical Experience Elements That Check Emotional States Every Day

In the survey, participants evaluated how the device's multisensory physical elements aided their daily emotional self-tracking (DEST). These elements included fire sounds, color-changing lights, a rotating handle, and emotional object selection. The hypothesis was that emotion regulation would be more effective with multisensory physical experiences, and results confirmed a positive impact. On a 1–5 scale, 'spinning handle' (3.7), 'sound of operation' (4), 'emotional object selection' (3.7), and 'color-changing light' (3.3) were all rated positively. Participants generally agreed that multisensory experiences benefited DEST.

The light color change received the lowest score, with 10 of 15 participants finding it helpful, while others felt the colors for negative emotions disrupted the room's atmosphere. The steering wheel interaction also scored low, as six participants didn't use it, though nine reported it helped them focus on emotions.

Emotional object selection ranked second highest, with 12 participants finding it helpful and six strongly agreeing. It aided in visualizing emotions, though some felt a stronger connection could be formed by creating their own objects.

The sound of burning firewood was rated the most effective, with 15 participants saying it helped recall emotions and focus on DEST. This aligns with research on ASMR sounds reducing stress and enhancing emotional arousal (Ohta & Inagaki, 2021; McGeoch & Rouw, 2020).

DISCUSSIONS AND CONCLUSION

The study explores how multi-sensory physical experiences affect daily emotion self-tracking (DEST), which enhances emotional self-awareness and regulation. Multi-sensory physical interaction engages users and improves their experience.

The study hypothesized that such experiences would enhance emotional awareness during DEST. A device called Reblower was designed for testing, and results showed a positive emotional impact after use, though no significant changes in self-reflection ability after five uses. Elements like "rotating handle," "sound activation," "emotion object selection," and "color-changing light" positively influenced DEST, with sound activation being the most effective.

The study used video demonstrations to minimize external influences but lacked a physical device for direct interaction, limiting the assessment of tactile experiences. Future research with a larger participant pool and a comparison group without mood-tracking experience could improve the generalizability of results.

This study explored whether multisensory physical experiences positively impact emotion regulation. The PANAS scores increased, suggesting that elements like handle rotation, sound, emotional object selection, and color lighting improved emotion confirmation (DEST), with the sound of firewood burning rated as the most helpful.

Key design implications include integrating body movement-based emotion regulation, providing customized sounds for emotional support, and enhancing emotion recognition through color and object selection.

ACKNOWLEDGMENT

This work was supported by the Technology Innovation Program (20018357, Development of CMF design for user biological and environmental information reactive printed electronic chameleon sheet) funded By the Ministry of Trade, Industry & Energy (MOTIE, Korea).

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