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## Emotion Regulation Training Companion: A Design Science Research

Thi Mai Huong Nguyen

*Augmented Human Lab, Department of Information Systems & Analytics, National University of  
Singapore, huongntm@comp.nus.edu.sg*

Chitrlekha Gupta

*Augmented Human Lab, Department of Information System and Analytics, National University of  
Singapore, chitrlekha@nus.edu.sg*

Suranga Nanayakkara

*Augmented Human Lab, Department of Information System & Analytics, National University of Singapore,  
suranga@ahlab.org*

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# Emotion Regulation Training Companion: A Design Science Research

T.M. Huong Nguyen, Chitrlekha Gupta, Suranga Nayakkara

Augmented Human Lab

Department of Information Systems & Analytics, National University of Singapore

{mia, chitrlekha, suranga}@ahlab.org

## ABSTRACT

Emotion regulation ability has a critical role in our physical and mental well-being. Strong emotion regulation capability is associated with academic success and life satisfaction. This capability also bolsters people's psychological strength to bounce back from negative, challenging emotional experiences. Although interest in designing emotion regulation support technology has grown significantly in the past few years, much of the effort has been put into helping users to change their physiological responses to emotional episodes. Limited works have focused on designing a solution that equips users with the necessary "tools" that enable them to master their own emotions. Informed by theories in affective neuroscience, we propose to design a conversational agent that helps users regulate their emotions by identifying their true cause, labeling them with a wide range of emotion words, and gradually building up their emotional granularity. By acquiring more fine-grained emotion concepts, we expect users to have more clarity and flexibility in navigating their emotional experiences.

## Keywords

Emotion Regulation, Conversational Agents, Artificial Intelligence, Affective Interfaces

## INTRODUCTION

Emotion regulation - the processes people use to influence the intensity, duration, and quality, or even the type of emotions they are experiencing (Gross, 1998) - has been found to have various effects on our health. Deficit in emotion regulation is a transdiagnostic factor underlying many psychological disorders such as anxiety, depression, substance abuse, etc. (Berking et al., 2011, Sloan et al., 2017). Emotion regulation as a targeted treatment has been shown to be effective across different types of psychopathology (Cameron et al., 2018, Berking et al., 2019). Having a solid ability to regulate emotions is correlated with better physical and mental health (Côté et al., 2010). Emotion regulation ability is vital for our health and a strong predictor of our success. Significant positive correlations have been found between emotion regulation ability and GPA in middle school and college students (Ivcevic and Brackett, 2014, Libbrecht et al., 2014).

While regulating emotions seems natural and intuitive, effective emotion regulation may require some training. What do you usually do when you encounter difficult tasks? Procrastinating and waiting until the last minute? Binge-watching Youtube to alternate negative feelings? Facing it and pushing yourself through? Effectively regulating emotions is not easy, and at challenging times, people can unconsciously use maladaptive strategies that lead to poor mental and physical health (Aldao et al., 2014). The ability to flexibly use different emotion regulation strategies to cope with challenging emotional experiences is called emotional resilience (Lazarus and Folkman, 1984). By strengthening one's emotional resilience, one can effectively navigate oneself out of negative experiences, possibly avoid putting oneself in negative emotional states, minimize their impact on one's cognition, and consequently improve one's overall quality of life and well-being. Despite the considerable interest in emotion regulation support technology, minimal works focus on empowering users to become emotionally more resilient. Motivated thus, we propose a design of an artifact that has the ability to help users regulate their emotions in the short term while assisting them in building up their emotional resilience in the long term.

RQ: How should we design an artifact that assists users in regulating their emotions and enable adaptive use of different emotion regulation strategies to strengthen their emotional resilience?

Recent advances in affective neuroscience suggest that emotion vocabulary may provide a path toward the question. Firstly, evidence shows that affect labeling - an act of calling out an emotion could actually reduce the intensity of such emotion (Kassam and Mendes, 2013, Burklund et al., 2014, Fan et al., 2018). In many cases, such a simple act is even more effective than other emotion regulation strategies such as reappraisal, avoidance, or distraction (Torre and Lieberman, 2018). Secondly, a growing body of research supports that emotion differentiation (also called emotional granularity), i.e., the ability to distinguish between same-valenced emotions, is a crucial skill for well-being (Kirby et al., 2014). High emotion differentiation is associated with healthier and more effective emotion regulation, while low emotion differentiation is linked to psychopathology (Nook, 2021). Positive emotion granularity is also strongly associated with psychological resilience (Tu gade et al.,

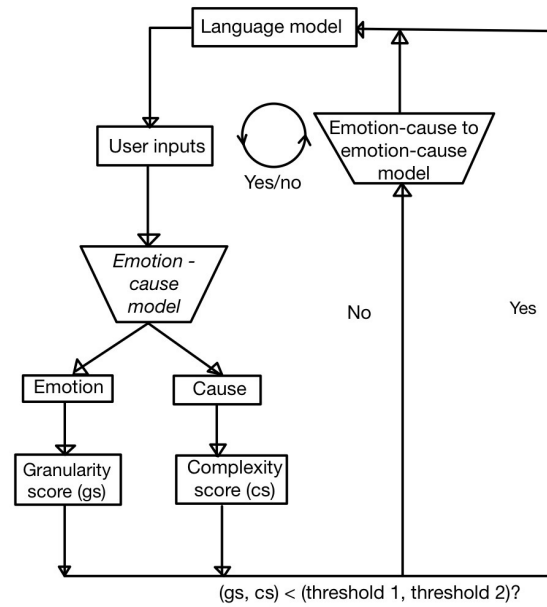
2004). These results are in line with predictions of Barrett’s constructionist theory of emotion (Barrett, 2017), which emphasizes the role of language in the generation of emotion (Lindquist et al., 2006, Lindquist et al., 2015). The theory of constructed emotion posits that the brain creates an instance of emotions in an ad-hoc manner, using past knowledge about emotions - organized as emotion concepts. Words help to seed these concepts; therefore, the more emotion words people have at their disposal, the more adept they are at navigating their emotions.

Given that affect labeling can regulate emotions, and high emotion granularity indicates emotional resilience (Tugade et al., 2004), a conversational agent could be a suitable design choice for the proposed artifact for three major reasons. First, to label users’ affect in high granularity, users need to understand the deep causes of their emotions. Thus, the artifact needs to help users break down their gross and complex emotions, explore their unaware bodily sensations and describe their feelings with more granularity. Therefore, multiple rounds of asking questions and getting answers are expected. Second, to suggest relevant emotion words, the artifact needs to understand users’ affective states. To do so, it needs to get a rich amount of user information. The Theory of Constructed Emotion (Barrett, 2017) suggests that people create an instance of emotion based on their internal affective state and the context they are in. While biosensors can measure some internal affective information, it is impossible to know the users’ context without their input. Third, advanced conversational agents, equipped with intelligent language processing modules, are capable of handling complex and personalized user input (Roller et al., 2021) while providing users with a natural and intuitive interface (Følstad and Brandtzæg, 2017). The agency of such an interface allows users to connect and respond to the artifact in a social way and encourages users to disclose their feelings honestly (Forlizzi et al., 2007).

**CONVERSATIONAL AGENT**

As emotions are a complex phenomenon, capturing the dynamics of emotions in every single context using predefined rules will be extremely costly. In recent years, large language models (LLMs) have grown tremendously in their ability to handle different language tasks, including different types of conversations such as open-domain (Zhang et al., 2020), empathetic (Rashkin et al., 2019), emotional support (Liu et al., 2021), and therapeutic (Shen et al., 2022). These models are trained on massive amounts of data and have demonstrated their exceptional ability to handle complex user inputs (Roller et al., 2021). For this reason, a large language model is a reasonable architecture for our agent.

Since the task of the model is to help users to scrutinize the possible subtle causes of their emotions, it needs to be able to make an inference whether the initial emotion cause of users can be broken down into more precise causes. Figure 1 shows the proposed architecture of the agent.



**Figure 1. Emotion Regulation Companion Architecture**

Users are first asked to label their current emotions and what causes them (e.g., I feel ... because ...). The input is then fed into an Emotion-Cause model to break down the emotion and the cause. Since users’ inputs can be complex, the Emotion-Cause model will need to identify the main cause and emotion from users’ input. The output cause and emotion will be fed into a complexity and granularity scorer. The complexity scorer is a module that computes whether the cause is complex (meaning there can be other underlying causes) or simple (meaning there is no other underlying cause). To train this scorer, a graph of (event, underlying emotion causes) will be built and extracted from the obtained emotion cause dataset. Granularity scorer is a scorer that assigns a score to emotion words based on their broadness. For example, bad has granularity = 3, while jittery may have granularity=1. The mapping will be heuristic. If the output emotion and emotion cause have a lower granularity score and complexity score than a certain threshold (to be determined through experiments), that indicates the identified emotion and its cause are good enough. This pair will then be fed into a language model to generate responses to users. Otherwise, the pair of emotion and cause will be fed into an Emotion-Cause to Emotion-Cause model. This model aims to identify the possible underlying cause of an input emotion cause. This model can be trained using the (event, underlying emotion causes) graph that was previously constructed. The output of this model is then fed into a language model to communicate with the user. The user can, in turn, tell the agent whether it has guessed the underlying cause correctly. If the underlying cause is not guessed correctly, the model will offer the user another guess from its list of outputs. The process of scrutinizing actual emotion causes can help users reflect on their emotions and thus achieve emotion regulation.

## EVALUATION

Following Hevner et al., (2004) guidelines for doing data science research, multiple iterations of design, development, and evaluation will be performed. Following Fitzpatrick et al., (2017). In the first evaluation cycle, the conversational agent will be evaluated on its usability. After gathering users' and experts' opinions in the first cycle, the agent will be further refined and developed for evaluation in the second cycle, where it is evaluated on its ability to regulate users' emotions. In this cycle, we plan to use a true experiment method to test our agent's ability to regulate users' emotions. Once this cycle is completed, a third cycle will be conducted to test the long-term effects of our agent. We will also use a true experiment with a randomized controlled group and a treatment group to test whether our agent can help users better differentiate their emotions and strengthen their coping ability.

## DISCUSSION

In this paper, we have described the design of an artifact that provides users with an elegant, integrated solution that they can use to regulate their emotions, while gaining awareness and clarity about their own feelings. In the process, users will learn more emotion words that enable flexible emotion generation in the long term. Having good awareness, clarity and flexibility, they will build up their emotional resilience and strengthen their mental and physical health. The success of our study can serve as evidence that supports the role of language in emotion regulation in particular and well-being in general. This will, in turn, have implications on education, healthcare, and even policy-making. Schools that want to improve students' quality and the academic outcome may instead put more resources into teaching children more emotion words and emotion concepts. Health providers can potentially use the artifact as an alternative method to regulate a patient's emotions when other methods are not suitable (e.g., when patients are paralyzed). Realizing the importance of language, governments should spend more effort to preserve languages that are spoken by the minority, as well as support the use of these languages at schools.

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