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Interpersonal Emotion Regulation and Stress Recovery: Examining Heart Rate Dynamics Through Soothing Audio

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ABSTRACT

This research investigates the role of interpersonal emotion regulation (IER) in stress recovery by examining heart rate responses to soothing audio interventions. Using a mixed-methods approach, Turkish and Iranian participants residing in Italy completed an online survey and a lab experiment. They were subjected to stress-induction procedure comprising distressing visual stimuli and cognitive tasks, followed by exposure to three intervention conditions: (1) soothing audio in their native language (in-group support), (2) soothing audio in a foreign language (out-group support), and (3) silence (intrapersonal regulation). Each participant experienced all conditions in a randomized order, with their heart rate continuously recorded. Results confirmed that the stress induction increased heart rate. Notably, soothing audio in the native-language led to significantly greater heart rate reduction compared to the other conditions, underscoring the benefits of in-group interpersonal support. Furthermore, higher self-reported use of soothing strategy (IERQ) was associated with better heart rate recovery only in the in-group condition. These outcomes emphasize the value of culturally attuned interventions for stress relief, suggesting that incorporating in-group interpersonal support in therapeutic settings can enhance physiological recovery and emotional regulation, particularly when an individual's coping resources are limited.

Keywords: heart rate, interpersonal, emotion regulation, stress

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INTRODUCTION

Stress is an inevitable component of daily life, influencing how we think, feel, and physiologically respond to stressors. In the moments of acute stress, the body's physiological systems activate rapidly to prepare us to cope (Gibbons, 2019). While traditional models have focused on intrapersonal strategies to regulate emotions, growing attention is being paid to the role of others, referred to as interpersonal emotion regulation strategies (Zaki & Williams, 2013). The effectiveness of these strategies may be influenced not only by the content of support but also by the social closeness of the source, such as shared group membership.

This study combines experimental and survey-based methods to examine whether ingroup soothing strategy promotes more effective physiological recovery compared to outgroup soothing or intrapersonal strategies. By focusing on heart rate recovery after acute stress, the research aims to contribute to existing models of interpersonal emotion regulation by examining the role of group dynamics in shaping the effectiveness of soothing strategy.

Chapter One reviews the theoretical and physiological foundations of stress and heart rate reactivity. Chapter Two introduces conceptual frameworks in interpersonal emotion regulation, with a focus on the "soothing" strategy. Chapter Three presents the influence of ingroup and outgroup dynamics on emotional support and regulatory processes. Chapter Four outlines the methodology of the study, including descriptions of the participants, procedures and measurement tools. Chapter Five presents the results of the study and followed by Chapter Six, which provides a discussion on the findings, practical implications, and suggests directions for future research.

CHAPTER 1

STRESS AND PHYSIOLOGICAL STRESS RESPONSE

1.1 Stress

The exploration of stress has been a focal point in biomedical sciences for over a century, with its modern foundations tracing back to the 19th century. Early contributors, such as Claude Bernard (1859) and Walter Cannon (1932; 1935), established key concepts in understanding stress. Bernard, known as a pioneer in experimental medicine, introduced the idea of "milieu intérieur," emphasizing the protective stability of internal environments for cellular health. Building on this, Cannon introduced the term "homeostasis," which describes how living systems maintain stable internal conditions necessary for survival. He also coined the "fight-or-flight" response, highlighting the body's automatic physiological reaction to perceived threats.

Hans Selye further advanced the understanding of stress by defining it as a non-specific response of the body to any demand placed upon it. He introduced the General Adaptation Syndrome (GAS), which outlines three phases of stress response: alarm, resistance, and exhaustion. Selye's work (Selye, 1936) distinguished between "distress" (negative stress) and "eustress" (positive stress), focusing on how various stressors evoke a consistent physiological response regardless of their nature.

In the late 1980s, Peter Sterling and Joseph Eyer (Sterling & Eyer, 1988) proposed the concept of "allostasis," which shifts the focus from stability (homeostasis) to the body's ability to adapt to change. Later other studies identified "allostatic load," the cumulative wear and tear on the body due to chronic stress (McEwen & Stellar, 1993). This idea underscored the physiological underpinnings of stress responses, particularly the role of the hypothalamic-pituitary-adrenocortical (HPA) axis in adapting to stressors.

Richard Lazarus (Lazarus & Folkman, 1984) enriched the literature on stress by introducing a cognitive-motivational-relational approach, emphasizing the role of cognition and individual differences in stress appraisal and coping strategies. He defined psychological stress as a relationship where environmental demands exceed one's resources, highlighting the importance of cognitive appraisal in determining stress levels.

Recent research has built on these foundational theories, offering new perspectives on stress. For example, Kim and Diamond (2002) proposed a three-component model of stress, emphasizing heightened arousal, perception of aversiveness, and lack of control as critical factors. This aligns with earlier findings by Weiss (1972), which noted that perceived control over stressors significantly influences stress responses. Thayer and colleagues (Thayer & Friedman, 2002; Thayer et al., 2012) introduced the neurovisceral integration model, which connects biological flexibility within the central autonomic network to an individual's ability to adapt to environmental demands. This model suggests that perceptions of threat and safety are vital stressors, with the default response being the fight-or-flight mechanism. In addition, Thayer et al. (2012) suggest that the heart rate variability is an index of "top-down" appraisals and is involved in vertical integration of the brain mechanisms important for the flexible control over behavior. Research also indicates that chronic perceptions of threat can lead to negative health outcomes, emphasizing the importance of adaptive stress responses.

In summary, stress is defined as an adaptive mechanism that mobilizes energy and motivates behavior in the face of danger. This complex response involves neurohormonal changes and subjective emotional experiences, influenced by nature, intensity, and duration of stressors, as well as individual factors. Furthermore, stress can have a major impact on well-being, mental health, and behavior. The relationship between stress, health and behavior is affected by nature, number, intensity, and persistence of the stressors as well as by individual characteristics, psychosocial resources and learned patterns of coping. While the negative effect of stress on mental health is well-known the possible protective factors that could explain a successful adaptation after stress exposure are still poorly explored.

Literature on the effects of stress has shown how exposure to different types and intensities of stress may be linked to both maladaptive and adaptive behaviors (e.g., de Waal & Suchak, 2010; Jose et al., 2000; O'Doherty, 1991 ;Taylor et al., 2000). For example, recent stressful events can be related to maladaptive ways of coping, such as engaging in drinking alcohol to relieve stress-related tension and negative affect (Goldman et al., 1991; Hermes et al., 2021), whereas a certain amount of acute stress can support prosocial acts toward others in need (e.g., Von Dawans et al., 2012). Different types of stressors experienced in different degrees, amounts and severity may affect the stress and behavior link in a specific way.

One important factor that regulates stress response is emotion regulation. In addition, social support and more importantly interpersonal emotion regulation can be an important factor in promoting a positive recovery after stress.

1.2 Stress Response and The Autonomic Nervous System

As previously mentioned, the stress response involves the activation of the autonomic nervous system (ANS). The ANS comprises well-organized structures, including nerves, neurotransmitters, and organs, that regulate involuntary physiological activities for maintaining homeostasis (Wehrwein et al., 2016). The anatomical distribution of the ANS involves several regions in two interconnected divisions: the central autonomic nervous system (CANS) and the peripheral autonomic nervous system (PANS).

The central autonomic nervous system functions as a control center of the autonomic nervous systems through coordinating physiological responses. The main components of the CANS are located in the brain, brainstem, and spinal cord, including the hypothalamus, medulla, amygdala, and prefrontal cortex (Benarroch, 1993). The CANS simultaneously processes sensory inputs coming from the body and regulates involuntary physiological reactions. Additionally, the CANS interacts with the limbic system and establishes a link between emotional responses and physiological changes (e.g., increased heart rate during fear or stress) (Hagemann et al., 2003; Levenson, 2014). The CANS operates closely with the peripheral autonomic nervous system while carrying out the processes. The peripheral autonomic nervous system consists of autonomic nervous system branches that extend outside the central nervous system (Furness, 2006). It includes nerves that directly carry the signals coming from the CANS to the target organs and tissues (Gibbons, 2019).

Functional distribution of PANS is primarily composed of two main divisions: the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). In addition, the enteric nervous system is considered a separate system since it regulates gastrointestinal functions independently (Furness, 2000; Furness, 2012). The sympathetic nervous system plays a key role in the body's "fight-or-flight" response by preparing it to react to stressful situations. On the other hand, the parasympathetic nervous system, called the "rest and digest" system, is responsible for conserving energy, promoting maintenance of the activities, and facilitating bodily functions during restful states (Gibbons, 2019; (McCorry, 2007). These systems reciprocally activate, and their antagonistic effects create a dynamic balance in activities in the body (Porges, 1995; Wehrwein et al., 2016).

During an emergency, the SNS is activated to organize immediate physiological responses to stressors and perceived threats. It originates from the thoracolumbar region of the spinal cord, particularly from segments T1 to L3 (Romagnano & Hamill, 1984). Its preganglionic fibers are relatively short and synapse in sympathetic ganglia near the spinal cord. This anatomical organization helps the SNS to transmit rapid signals in the case of stress (Gibbons, 2019). In contrast to the SNS, the PNS becomes dominant in states of calm and safety. Anatomically, the preganglionic neurons originate from craniosacral segments and synapses in parasympathetic ganglia, which are located near or within the target organs. This allows for precise and localized control over physiological functions (Gibbons, 2019)

Sympathetic activation coordinates a range of physiological changes that are essential for survival. These responses are central to stress reactivity, a term that describes the body's immediate, intense, and sustained reactions to stressful stimuli (Schulz et al., 2005). Stress reactivity is characterized by the activation of the SNS and the simultaneous suppression of the PNS. However, individual differences exist in both the intensity of these reactions and the ability to regulate them (Campbell & Ehlert, 2012). An adaptive stress response typically aligns with the intensity of the perceived stress and returns to the baseline level once the threat is no longer present (Kiecolt-Glaser et al., 2020).

The acute stress response begins as sensory organs transmit information to the brain, specifically to the amygdala, the brain region responsible for emotional processing. The amygdala interprets the incoming stimuli and, after detecting danger, rapidly transmits signals to the hypothalamus (Gibbons, 2019). Subsequently, the hypothalamus triggers the activation of the SNS by sending signals to the adrenal glands, which releases the epinephrine hormone into the bloodstream. The increased circulation of epinephrine leads to raised heart rate and blood pressure, resulting in enhanced blood flow to vital organs and skeletal muscles (Benarroch, 1993). Moreover, the SNS induces bronchodilation that facilitates improved oxygen intake to meet metabolic needs. It also stimulates the liver to release glucose into the bloodstream, thus providing an immediate energy source for muscular activity. Blood flow is redirected from the non-essential organs, such as the digestive and urinary systems, toward critical structures, including skeletal muscles and the brain (Porges, 1995; Wehrwein et al., 2016). Other physiological responses involve enhancing vision by pupil dilation (Loewy, 1990) and supporting thermoregulation by increasing sweating during physical activity (McCorry, 2007).

As the initial release of epinephrine decreases, the hypothalamus activates another component of the stress response system, the hypothalamic-pituitary-adrenal (HPA) axis. This network includes the hypothalamus, pituitary gland, and adrenal glands (Hellhammer et al., 2009). If the brain continues to perceive a threat, the hypothalamus produces a corticotropin-releasing hormone (CRH), which stimulates the pituitary gland to secrete adrenocorticotropic hormone (ACTH). ACTH then prompts the adrenal cortex to release cortisol into the bloodstream (Chrousos, 2009). In the short term, cortisol helps the body to be aroused and defends itself against the threat, however, studies show that prolonged activation of the HPA axis can impair the regulatory systems (Hamer et al., 2012; Kenney & Ganta, 2014; Pongratz & Straub, 2023; Sapolsky et al., 2000; Wehrwein et al., 2016). Since PNS prepares the body for rest, maintaining a balance between the two systems is crucial for preventing the long-term negative effects of stress.

1.3 Heart Rate and Stress Reactivity

Heart rate, measured in beats per minute (bpm), represents the number of the heartbeats occurring within one minute and is widely used as a physiological indicator to estimate stress levels (Giannakakis et al., 2019). It is a crucial physiological parameter reflecting cardiac activity and overall cardiovascular health. Heart rate can be influenced by several factors such as age, sex, activity level, physical exercise, and general health status. In healthy adults, the normal resting heart rate typically ranges between 60 and 100 bpm. Previous studies suggested that the resting heart rate tends to decline with age (American Heart Association, 2024; Almeida-Santos et al., 2013; 2016).

In healthy populations, research consistently indicates that women have a higher resting heart rate than men, even controlling for age and other factors, with the difference of 3 to 7 bpm (Almeida-Santos et al., 2013; Lucas et al., 2020; Quer et al., 2020). While this sex-related difference is present across all age groups, Valentini and Parati (2009) reported in their study that evidence regarding its increase with age remains inconsistent across studies. Moreover, women have been found to display a greater increase in heart rate in response to stress compared to men (Krantz et al., 2004; Lucas et al., 2020).

Heart rate is usually lower during sleep than during the waking period, with an average difference of approximately 14 bpm, regardless of age (Ben-Dov et al., 2007; Jaquet et al., 1998). Physical exercise is another factor that influences heart rate. Regular physical activity is associated with a reduction in heart rate and enhanced cardiovascular efficiency, as

individuals who engage in regular training tend to have lower heart rate levels than those who do not perform regular physical exercise (Borresen & Lambert, 2008). Furthermore, elevated body mass index (BMI) has been shown to impact heart rate negatively (Quer et al., 2020; Dimkpa et al., 2023). Excess body weight is linked to increased heart rate and sympathetic activation, contributing to cardiovascular risks (Després, 2012).

During acute stress periods, the heart rate undergoes significant changes due to the body's physiological stress response. A major cardiovascular center located in the medulla of the brain integrates sensory input from the cerebral cortex, limbic system, baroreceptors, and chemoreceptors. In reaction to this sensory input, the cardiovascular center regulates the heart rate by balancing the SNS and PNS (Shaffer & Venner, 2013). Increased SNS activity or reduced PNS activity leads to a faster heart rate. In contrast, low SNS activity or high PNS activity slows the heart rate (Giannakakis et al., 2019).

As discussed in previous pages, this response is primarily driven by the SNS and the hypothalamic-pituitary-adrenal axis. Activation of the SNS stimulates the release of epinephrine, a hormone that directly influences heart rate. The secretion of epinephrine leads to an increase in both heart rate and blood pressure, helping the delivery of more oxygenated blood to vital organs during the fight-or-flight response. During the period of stress, the heart rate significantly increases, and it can exceed 100 bpm (Henning & Krawiec, 2023).

1.4 Stress Induction and Heart Rate

Psychological stress not only affects emotional states but also triggers physical responses by activating the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system (Giles et al., 2014). Studies in experimental psychology examine how acute stressors influence mood, cognitive performance, and physiological systems. To investigate these effects, the researchers design stress induction protocols that manipulate stress as an independent variable under controlled conditions (Ferreira, 2019). When developing experiments that include stress induction, it is essential to use non-invasive techniques that create moderate and short-term stress without causing lasting harm. Ferreira (2019) mentioned that effective stress induction procedures typically involve novelty, unpredictability, lack of control, representing a threat of damage or potential loss, and social assessment.

1.4.1 Stress Induction Methods

Traditional protocols for stress induction include the Trier Social Stress Test (TSST) and the Cold Pressor Task (CPT). The most commonly used method, the TSST, involves three parts: a 10-minute preparation for an oral presentation in front of judges, a 5-minute speech, and a 5-minute mental arithmetic task (Kirschbaum et al., 1993). Throughout all parts, the presence of evaluators enhances psychosocial stress. Although it is a well-established protocol, the social evaluation component can lead to inconsistent stress responses due to individual differences in participants' vulnerability to social evaluation (Ferreira, 2019). Another widely used test, the CPT, induces a stress response by having participants sequentially immerse their hands in cold and hot water. However, it is limited by its ambiguity in determining whether physiological responses are due to psychosocial stress or physical pain (Giles et al., 2014). For these reasons, researchers have been developing new, more practical and time-efficient protocols to meet the needs of experimental psychology.

a) Mannheim Multicomponent Stress Test (MMST)

An alternative protocol for stress induction is the Mannheim Multicomponent Stress Test (MMST), designed by Kolotylova et al. (2009). It aims to induce a relatively high level of stress through using four different kinds of stressors: cognitive, emotional, acoustic, and motivational (Kolotylova et al., 2009). Unlike the TSST, the MMST does not include a social evaluation component. The procedure starts with a baseline part during which participants can relax. Then, a 5-minute stress induction part begins with presenting negative affective images. During the first minute, participants are simultaneously exposed to an emotional stressor (negative images) and an acoustic stressor (white noise). To prevent habituation, a positive affect image is presented after every five negative pictures. Following the initial minute, participants are tasked with a cognitive challenge involving an arithmetic task. They are asked to concentrate on images that contain numbers and sequentially add each new number to the running total, while negative images continue to be displayed on the screen and white noise is played through headphones. From the beginning of the task, participants are informed that they will receive a reward starting at €100, however, the amount decreases with each mistake they make in the arithmetic task. This element helps to create a motivational stressor for the MMST (Reinhardt et al., 2012).

Previous research has shown that the MMST protocol induces significant changes in subjective stress ratings, heart rate, and electrodermal activity (Ferreira, 2019; Reinhardt et al.,

2012; Kolotylova et al., 2009). In their study, Kashi et al. (2024) found a significant increase in state anxiety and heart rate; however, unlike the previous findings, they did not observe an increase in the saliva cortisol levels. Overall, the MMST is an effective method for investigating the effects of stress on cognitive performance, emotional responses, and physiological activity without the confounding influence of social evaluation (Ferreira, 2019). Given these advantages, it is considered a cost-effective and time-efficient alternative for studies aiming to assess stress responses in a controlled setting (Reinhardt et al., 2012).

b) International Affective Picture System (IAPS)

The International Affective Picture Systems (IAPS) is a widely recognized and validated tool used in psychological and emotional research to stimulate and evaluate emotional responses (Lang, Bradley & Cuthbert, 2005). It is designed to provide a standardized set of images that evokes a range of emotional reactions. It was originally developed in 1997 and has been updated by adding new images (Branco et al., 2023). The IAPS includes over a thousand color photographs in 20 sections, depicting everyday situations, people, and environments. During standardization studies, both adult and child participants evaluated each image in the IAPS using the Self-Assessment Manikin (SAM), a nine-point Likert scale with three dimensions: valence, arousal, and dominance (Bradley & Lang, 2000). Valence dimension measures the pleasantness or unpleasantness of the image, arousal dimension reflects the level of excitement it triggers, and dominance dimension refers to the degree of control an individual feels over their emotional reaction to the image (Bradley & Lang, 1994)

The IAPS is commonly used in various fields such as psychology, neuroscience, and behavioral research to examine emotional processing, attention, and cognitive responses to emotional stressors. The IAPS images can be employed to induce stress to participants and subsequently measure physiological reactions, including heart rate, cortisol level, and skin conductance (Ferreira, 2019). The protocol has been validated in different populations and cultures, which makes it a reliable tool for implementing in diverse research contexts (Moltó et al., 2013). For example, Tok and colleagues (2010) were the first to use the IAPS with a Turkish sample. The results demonstrated significant correlations with the American normative data, suggesting that images are capable of stimulating similar emotional responses across different cultural groups (Tok et al., 2010).

1.4.2 Stress Response Measurement

Following exposure to stressors, individuals may exhibit a range of emotional, cognitive, behavioral, and physiological reactions triggered by stress-inducing stimuli (Crosswell & Lockwood, 2020). Depending on the nature of the studies, these stress responses can be measured using self-report instruments (e.g., Emotion Regulation Questionnaire), behavioral observations (e.g., facial expression coding), and physiological indicators (e.g., cardiac activity). Physiological stress indicators are largely involuntary movements that are mainly mediated by the ANS (Gibbons, 2019). These indicators are composed of various biosignals reflecting the body's vital functions. Commonly used physiological measures include cardiac activity - electrocardiography (ECG) and blood volume pulse (BVP), brain function assessed through electroencephalography (EEG), skin conductance via electrodermal activity (EDA), and muscle tension measured by electromyography (EMG) (Giannakakis et al., 2019). In studies examining stress-related changes in heart rate, the ECG is frequently used to capture detailed cardiac activity.

Figure 1

ECG signal illustrating characteristic peaks (P, Q, R, S, T) and RR intervals

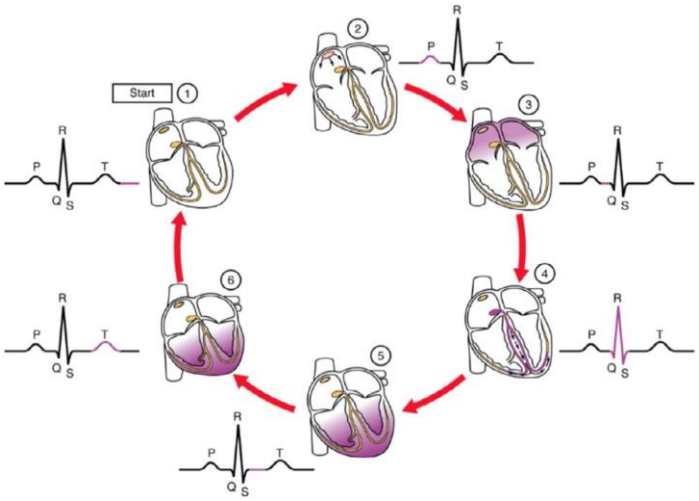
Note. Adapted from Giannakakis et al. (2019).

ECG is a non-invasive technique that records the electrical activity produced by the heart during each cardiac cycle (Kaplan-Berkaya et al., 2018). It involves the placement of electrodes on different parts of the body, such as the chest and legs. Every time the heart beats, it generates a sequence of electrical signals that can be detected and visualized as a waveform (Berntson, Quigley & Lozano, 2007). The ECG waveform consists of characteristic labeled P, Q, R, S, and T (Figure 1). Each of these characteristics represents different phases of the cardiac

cycle, provided in Figure 2 (Kaplan-Berkaya et al., 2018). Researchers often analyze the R-R peaks to understand changes in arousal and stress (Giannakakis et al., 2019).

Figure 2

Cardiac cycle with the associated waves of an ECG



Note. Adapted from Kaplan-Berkaya et al. (2018)

ECG is widely used in psychophysiological research due to its ability to detect rapid changes in heart activity with high temporal precision (Lackner et al., 2014). It enables real-time monitoring of emotional arousal, cognitive effort, and stress responses (Hackl-Wimmer et al., 2025). Therefore, ECG is a commonly preferred tool for measuring heart rate, examining heart rate rhythms, and detecting heart abnormalities (Kaplan-Berkaya et al., 2018).

1.5 Heart Rate as a Measure of Recovery

Once the stressor is no longer present, the body enters the recovery phase under the control of the parasympathetic nervous system. It counterbalances the effects of the sympathetic nervous system by promoting rest and recovery for the body. Anatomically, the PNS originates from the craniosacral regions of the central nervous system. It consists of preganglionic neurons that emerge from the brainstem and the sacral spinal cord segments from S2 to S4 (Gibbons, 2019). Contrary to the SNS, which has ganglia located far from the target organs, the parasympathetic ganglia are found near the target organs, allowing for more localized control over the PNS functions (McCorry, 2007).

The parasympathetic activity operates mainly through the vagus nerve (Wehrwein et al., 2016). Originating from the brainstem, the vagus nerve connects the brain to various vital

organs, including the heart, lungs, digestive system, and kidneys (Porges, 1995). It carries efferent signals from the brain to regulate involuntary bodily functions such as heart rate, digestion, and breathing. Conversely, afferent signals transmit information from these organs back to the brain (Wehrwein et al., 2016). As a crucial part of the PNS, the vagus nerve facilitates the transition from a state of arousal to relaxation, promoting recovery and homeostasis.

To create recovery in the body, the PNS is responsible for decreasing heart rate, promoting digestion, stimulating glandular secretions, and conserving energy. The PNS slows the heart rate and lowers blood pressure through vagal activity (Porges, 1995). Its mechanism involves the release of acetylcholine (ACh) from the vagus nerve and preganglionic neurons at synapses in the ganglia, followed by further ACh release from the postganglionic neurons at target organs (Loewy, 1990). This suppresses the activity of the sinoatrial (SA) node, which is responsible for generating electrical impulses that regulate the heart's rhythm. Additionally, the PNS controls the transmission speed of the electrical signals in the heart. By inhibiting the electrical activity of the heart, parasympathetic activity promotes reduced heartbeat and relaxation. Consequently, this mechanism leads to energy being conserved in the body under resting conditions.

Furthermore, the PNS stimulates the digestive system's movements. It activates salivary production, gastric acid secretion, and pancreatic enzymes release (exocrine and endocrine) (McCorry, 2007). Moreover, it operates the muscle movements in the digestive system, all these contributing to digestion and absorption of nutrients.

In addition to its influence on the cardiovascular and digestive systems, parasympathetic activation stimulates bronchoconstriction, making breathing more controlled and efficient during rest. Other significant effects of PNS are contracting the urinary bladder for urination (Holstege, 2005) and increased blood flow in the genital organs for sexual arousal (Gibbons, 2019). It also promotes rest by constricting the eye pupil, decreasing the amount of light entering the eyes, and enhancing near vision (McCorry, 2007). In a healthy heart, the resting heart rate is primarily regulated by parasympathetic mechanisms (Olshansky et al., 2008). Porges (1995) states in the Polyvagal Theory that the vagus nerve operates as a brake system in the body, and it slows down the heart rate.

Heart rates serve as a significant physiological indicator of stress recovery and emotional regulation. Following experiencing stress reactivity and an increase in heart rate,

Cole et al. (1999) defined heart rate recovery (HRR) as the heart's ability to return to the baseline level. HRR is coordinated by the combined process of vagal activation and sympathetic withdrawal (Peçanha et al., 2014). The activation of the parasympathetic mechanism can reduce the heart rate to 20 or 30 bpm or even temporarily pause (Tortora & Derrickson, 2018). Similar to stress reactivity, HRR is influenced by multiple factors, including age, sex, stress duration, response intensity, physical activity level, and sleep quality (Peçanha et al., 2014; Trevizani et al., 2012; Carnethon et al., 2012; Daanen et al., 2012). In addition, studies have shown that trained athletes exhibit a greater HRR than untrained or less-trained individuals (Imai et al., 1994; Peçanha et al., 2014).

Prolonged exposure to stress disrupts essential functions coordinated by the PNS. This prevents the body from returning to a state of calm and relaxation. Over time, this disruption can contribute to chronic health problems (Rozanski et al., 1999). Combined with sympathetic overactivity, chronic stress has been linked to an increased risk of heart attacks and strokes, cardiac arrhythmias, atherosclerosis, and elevated blood pressure (Golbidi et al., 2015; Boehm & Kubzansky, 2012; Das & O'Keefe, 2006). Moreover, parasympathetic activity is involved in regulating immune responses, and its interaction with the SNS significantly influences how the body responds to stress-related health conditions (Kenney & Ganta, 2014). Therefore, parasympathetic activation is vital for long-term stress recovery. While the SNS prepares the body for taking actions, the PNS helps the body to rest, recover, and return to physiological equilibrium. Thus, maintaining a balance between these two systems is crucial for protecting the body from the harmful effects of chronic stress and supporting overall well-being.

CHAPTER 2

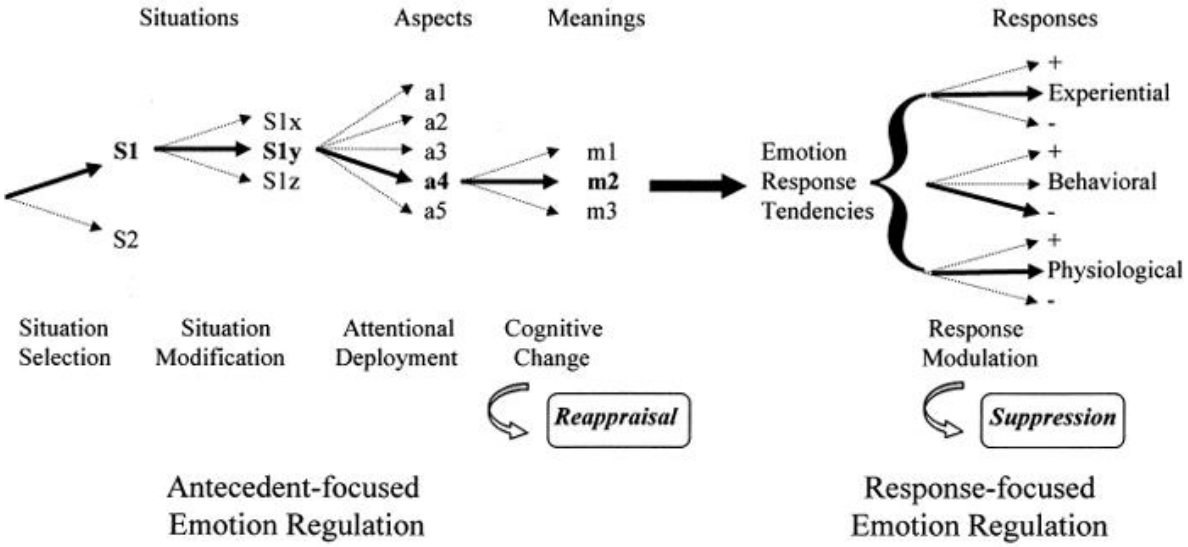
INTERPERSONAL EMOTION REGULATION

2.1. Emotion Regulation and Stress

Emotion regulation is a multidimensional process where individuals manage various aspects of their emotions, such as timing, intensity, and duration, as well as the expression of emotion-related thoughts and behaviors, to adapt to experiences and achieve goals (Calkins & Hill, 2007; Eisenberg et al., 2007; Gross, 1998; 2013). From the Biopsychosocial perspective, it operates on biological, behavioral, and social levels (Calkins, 2010) and involves dynamic actions and complex physiological responses, which may be automatic or controlled and occur both consciously and unconsciously (Perry & Calkins, 2018). Emotion regulation not only serves to down-regulate negative emotions but also to adjust positive emotions, depending on the context (McRae & Gross, 2020). It functions as both an intrinsic and extrinsic mechanism, shaped by individual traits and the social environment (Cole et al., 2004; Perry & Calkins, 2018; Thompson, 1994).

Figure 3

The Process Model of Emotion Regulation



Note. Adapted from Gross (2001).

Gross (2015) defines emotion regulation as the processes through which individuals influence the onset, intensity, duration, and expression of their emotions. These processes can be automatic or controlled, conscious or unconscious, and occur at various stages of the

emotion-generating process. One of the most widely cited frameworks, Gross's (1998, 2015) process model (see Figure 3), distinguishes between antecedent-focused strategies, like cognitive reappraisal, and response-focused strategies, such as expressive suppression. More recent models, such as Sheppes et al. (2015), emphasize the dynamic selection and application of strategies based on situational demands, individual goals, and available resources. These models highlight that emotion regulation is a set of interrelated processes that vary in adaptiveness, depending on context and individual differences.

Research consistently shows that effective emotion regulation is crucial for coping with stress. For example, Aldao, Nolen-Hoeksema, & Schweizer (2010) found that strategies like cognitive reappraisal are linked to lower levels of anxiety and depression, while maladaptive strategies like suppression are associated with higher psychopathology. Similarly, Troy et al. (2010) showed that cognitive reappraisal buffers the negative effects of high stress on depressive symptoms. Furthermore, Moore et al. (2008) demonstrated that individuals with greater emotion regulation abilities show reduced physiological stress responses, such as lower cortisol levels, in response to stress-inducing tasks.

Emotion regulation strategies differ markedly in their psychological outcomes. Cognitive reappraisal, an antecedent-focused strategy involving changing one's interpretation of an emotion-eliciting situation, is generally associated with more adaptive outcomes, including better emotional well-being, enhanced interpersonal functioning, and lower risk of psychopathology (Gross & John, 2003; Aldao et al., 2010). In contrast, expressive suppression, which entails inhibiting the outward signs of emotion after it has been generated, is linked to increased physiological arousal, impaired memory, and higher levels of psychological distress (John & Gross, 2004; Moore, Zoellner, & Mollenholt, 2008). Sheppes et al. (2015) emphasized that strategy effectiveness is not absolute but context-dependent, and thus, identifying the most appropriate regulatory tactics for specific situations is essential for fostering resilience and adaptive functioning. This is emphasized by the strong role played by emotion regulation in mental health.

Indeed the lack of the ability to regulate emotion, that is emotional dysregulation—defined as difficulty in effectively managing emotional responses—is a transdiagnostic factor implicated in numerous psychological disorders, including depression, anxiety disorders, borderline personality disorder, and post-traumatic stress disorder (Linehan, 1993; Campbell-Sills & Barlow, 2007). Empirical research has demonstrated that individuals with mood and

anxiety disorders often exhibit heightened use of maladaptive strategies, such as rumination and avoidance, and reduced use of adaptive ones like reappraisal (Aldao et al., 2010). Campos, Frankel, and Camras (2004) further argue that early emotion regulatory capacities are critical for developmental trajectories, affecting social competence and mental health across the lifespan. Given this evidence, clinical interventions increasingly focus on enhancing emotion regulation skills, as seen in therapies such as Dialectical Behavior Therapy (DBT) and Emotion Regulation Therapy (ERT), which are specifically designed to address chronic emotion dysregulation by teaching more flexible and adaptive strategies.

Finally, emotion regulation can be divided into two distinct yet complementary forms: intrapersonal and interpersonal emotion regulation (Zaki & Williams, 2013). *Intrapersonal emotion regulation* focuses on the individual's internal cognitive mechanisms, while *interpersonal emotion regulation* tries to understand the role of social interactions and relations influencing the regulatory abilities. In the next paragraph we will address interpersonal emotion regulation.

2.2 Interpersonal Emotion Regulation

While traditional models of emotion regulation have primarily focused on intrapersonal processes—those that occur within the individual—growing research has highlighted the significance of interpersonal emotion regulation (IER), which involves using others to help modulate emotional states (Zaki & Williams, 2013). This shift acknowledges that emotional experiences are often embedded in social contexts and that people routinely seek support, comfort, validation, or distraction from others as part of their regulatory efforts (Niven, Totterdell, & Holman, 2009).

Intrapersonal and interpersonal emotion regulation are closely intertwined. Intrapersonal regulation involves internal mechanisms like reappraisal or suppression. In contrast, interpersonal regulation entails actively engaging others, such as talking to a friend, seeking empathy, or eliciting advice, to influence one's emotions (Zaki, 2020). These domains are not mutually exclusive but function in a complementary manner. For example, the use of interpersonal strategies can enhance or substitute intrapersonal regulation, especially under high stress when cognitive resources may be depleted (Marroquín, 2011). Thus, understanding emotion regulation requires a dual perspective that considers both individual and social regulatory capacities.

Interpersonal emotion regulation refers to the deliberate use of social interactions to influence one's emotional states (Zaki & Williams, 2013). This includes seeking out others to help reduce negative emotions (e.g., venting, emotional support), amplifying positive ones (e.g., sharing joy), or gaining perspective (e.g., cognitive reframing through conversation). The Social Baseline Theory further supports this idea, suggesting that human brains are wired to expect and benefit from social regulation of emotional states, as it reduces the metabolic cost of coping with stress (Coan & Sbarra, 2015).

Interpersonal emotion regulation plays a crucial role in shaping emotional experiences through social interactions, and recent research has highlighted its conceptual diversity and applications across various contexts. Understanding these frameworks can deepen insights into how individuals navigate their emotions in relation to others. In one framework, Zaki and William's (2013) conceptualize IER as a process that can be either *intrinsic*, where individuals seek to regulate their own emotions through others, or *extrinsic*, where individuals attempt to influence the emotional state of others. Moreover, the framework proposes two regulatory strategies: response-dependent and response-independent (Zaki & Williams, 2013). These strategies differ based on whether they require specific feedback from the interaction partner. Response-dependent strategies rely on the presence of a particular response from other people, such as supportive or empathetic feedback, for regulation to be effective. For example, social sharing of emotions tends to be most beneficial when the listener responds supportively or enthusiastically, thereby helping to regulate the individual's emotional state (Wagner et al., 2014). On the other hand, response-independent strategies involve regulatory behaviors that do not depend on others' reactions. These are typically self-initiated actions, such as labeling one's own emotions, which can facilitate emotional regulation regardless of the social partner's response (Zaki & Williams, 2013).

In their study, Williams and his colleagues (2018) contributed IER framework by focusing specifically on intrinsic IER and introducing the Interpersonal Regulation Questionnaire (IRQ). They proposed that the effectiveness of the IER strategies is influenced by two factors: tendency and efficacy. Tendency means how frequently individuals seek emotional support from others, while efficacy refers to the degree to which individuals believe that seeking social support will successfully regulate their emotions (Williams et al., 2018). In addition, the study's findings suggest that IER tendency and efficacy are related but distinct from personality traits, such as introversion and extraversion. For example, an individual may

be introverted yet still frequently engage in IER if they believe it to be an effective strategy for managing their emotions (Williams et al., 2018).

Another model described in the literature is the framework for interpersonal emotion regulation proposed by Hofmann, Carpenter, and Curtiss (2016), which emphasizes the role of emotional processes in both individual functioning and relational dynamics. In his earlier work, Hofmann (2014) criticized Gross's process model for its limited capacity to account for the flexibility and adaptability required in complex social situations. He argued that suppression, which is typically viewed as maladaptive in Gross's model, can be beneficial in specific interpersonal contexts. For instance, suppressing aggressive reactions during a conflict may contribute to maintaining social harmony, suggesting that the effectiveness of emotion regulation strategies is context-dependent (Bonanno & Burton, 2013).

Unlike Zaki and William's framework, the recent model involves information about only intrinsic emotion regulation and does not distinguish between response-dependent and response-independent strategies (Hofmann et al., 2016). The model proposed that IER is composed of four sub-factors: enhancement of positive affect (EPA), perspective taking (PT), soothing (S), and social modeling (SM) (Gökdağ, 2021; Hofmann et al., 2016). EPA is described as a tendency to reach out to others to increase positive emotions. PT involves using others' viewpoints to gain a better understanding of a situation. Soothing is used when individuals want to seek sympathy and compassion from others to manage their emotions. Lastly, SM refers to observing others and using their thoughts or behaviors as a guide to handle situations (Hofmann et al., 2016; Ray-Yol et al., 2022). In the present study, Hofmann and colleagues' (2016) model was adopted, as the focus is on understanding intrinsic rather than extrinsic aspects of IER, particularly the role of soothing in stress management.

2.3 IER and Stress Management

The relevance of IER in stress management is well-supported by empirical evidence. Individuals who actively engage in interpersonal regulation strategies during stressful situations tend to report lower levels of perceived stress and exhibit greater emotional resilience (Williams et al., 2018). For example, Marroquín (2011) demonstrated that people with greater tendencies to seek social reassurance or emotional support are better able to cope with acute stressors and report fewer depressive symptoms. Similarly, Barthel, Hay, Doan, and Hofmann (2018) argued that individuals with limited social support and poor interpersonal skills are more

vulnerable to depression. Supporting this, a study conducted among Korean university students found that upregulating positive emotions improved perception of social support, which in turn contributed to a reduction in depressive symptoms (Seong et al., 2024). Furthermore, individuals who engage in diverse relationships to meet different emotion regulation needs, such as preferring one person for seeking comfort and another for encouragement, tend to report higher well-being (Cheung, Gardner, & Anderson, (2015). This finding suggests that greater flexibility in utilizing diverse intrinsic IER strategies may enhance emotional functioning.

Romantic relationships, in particular, provide a salient context for IER. Prior research has demonstrated that interpersonal regulatory processes within such close bonds can effectively support individuals dealing with psychological difficulties (Horn & Maercker, 2016; Levy-Gigi & Shamay-Tsoory, 2017). In a laboratory-based study, Levy-Gigi and Shamay-Tsoory (2017) randomly assigned romantic partners to the roles of target and regulator. After exposure to emotionally negative stimuli, targets reported better emotion regulation when supported by their partners compared to when relying solely on intrapersonal strategies.

Furthermore, IER is particularly important in collectivist cultures or in situations where shared emotional experiences (e.g., grief, trauma) require coordinated coping efforts (Mesquita, 2010). Liddell and Williams (2019) found that IER is more effective in reducing stress among people with high collectivist self-construal (e.g., East Asia) than people with high individual self-construal (e.g., Western Europe). Interpersonal support in these settings not only promotes a sense of social connectedness but also helps buffer the emotional and physiological consequences of stress by reducing uncertainty and facilitating more adaptive interpretations of adverse events (Coan, 2011).

While effective use of IER strategies promotes the well-being of individuals, maladaptive forms of IER can contribute to emotion dysregulation and the development or maintenance of psychopathology (Barthel et al., 2018; Messina et al., 2021). Such maladaptive uses of IER may include overreliance or underreliance on others, excessive reassurance seeking, turning to unhelpful or emotionally unavailable individuals, and engaging in regulation attempts in inappropriate settings (Dixon-Gordon, Bernecker & Christensen, 2015). Hofmann (2014) introduced a model for explaining mood and anxiety disorders in the scope of IER. According to the model, close relationships, such as family, friends, or romantic partners,

can function as sources of perceived safety. However, for individuals with anxiety disorders, excessive dependence on these "safety figures" may lead to avoidance behaviors, which in turn reinforce anxiety symptoms. Therefore, integrating the IER perspectives into the treatment of anxiety disorders may help identify and address maladaptive relational patterns (Barthel et al., 2018).

Research has shown that different patterns of reassurance seeking are related to distinct forms of psychopathology. Depressive symptoms, for instance, are often associated with reduced tendency in reassurance-seeking behaviors, possibly indicating social withdrawal and isolation. In contrast, individuals with anxiety and borderline personality disorders tend to engage in excessive use of reassurance-seeking (Dixon-Gordon et al., 2015). These findings suggest that both the absence and overuse of IER strategies can contribute to emotional dysfunction.

In a clinical context, IER offers a valuable framework for enhancing emotional processing, particularly in group-based interventions. Messina et al. (2021) argued that group therapy facilitates several interpersonal regulatory mechanisms, including social sharing through emotion expression, perspective taking by considering alternative viewpoints, and social modeling by observing others' coping strategies (Hofmann, 2016). Moreover, the group setting can help identify maladaptive use of IER patterns and promote awareness of their consequences, thereby allowing participants to develop a deeper understanding and adopt more adaptive interpersonal regulation strategies (Messina et al., 2021).

In summary, understanding IER enriches the broader models of emotion regulation by acknowledging the essential role of social relationships in managing emotional challenges. Moreover, both cultural background and the nature of relationships shape how individuals engage with IER strategies, underlining the importance of context-sensitive approaches. Importantly, IER also has important clinical implications, as enhancing interpersonal regulatory skills may serve as a protective factor against stress-related disorders and contribute to more effective outcomes in psychological interventions.

2.4 The Role of Soothing in Emotion Regulation

IER consists of various strategies individuals use to manage their emotional states through social interactions. Among these, soothing refers to the tendency to seek comfort, relief, and compassion from others during times of emotional distress (Hofmann et al., 2016).

As a subdimension of the Interpersonal Emotion Regulation Questionnaire (IERQ), soothing reflects how much individuals rely on emotionally supportive figures to reduce internal discomfort (Hofmann et al., 2016). Soothing can be a useful strategy for fostering short-term relief and a sense of safety, especially when individuals lack intrapersonal regulatory skills to manage their emotional experiences (Chan & Rawana, 2021). Supportive verbal and physical gestures may serve a soothing function by helping individuals perceive situations as less threatening, promoting social bonding, and facilitating recovery by mitigating the impact of stressful experiences (Coan & Sbarra, 2015; Lakey & Orehek, 2011; Marroquín, 2011). These interpersonal responses, in turn, activate parasympathetic processes that support emotion regulation and resilience, particularly in the aftermath of acute stress.

Research in early development suggests that caregiver-provided soothing plays a significant role in the development of a child's emotion regulation capacity (Feldman, 2007; Lobo & Lunkenheimer, 2020). Responsive behaviors such as gentle touch, calm vocalizations, and physical closeness contribute to an infant's ability to co-regulate arousal and gradually develop self-regulatory mechanisms (Kiel et al., 2024; Mohr et al., 2019). In a longitudinal analysis, Hillgrove-Stuart et al. (2015) found that frequent use of soothing behaviors during infancy, particularly in response to distress, supports the development of secure attachment and may serve as an early form of emotion regulation.

Most studies have shown that insecure attachment styles are negatively associated with both social support and support-seeking behaviors, whereas secure attachment style tends to correlate positively with such indicators (Mallinckrodt & Wei, 2005; Ognibene & Collins, 1998). Specifically, individuals with anxious attachment, who are characterized by heightened emotional needs and fear of rejection, may be more likely to seek comfort from others as a coping mechanism during emotional distress. Consistent with this, in the study examining the role of attachment styles in IER, Gökdağ (2021) found a strong positive association between anxious attachment style and the use of soothing as an IER strategy. However, given that anxious attachment is also linked to a greater vulnerability to psychological distress, such as depression and social anxiety, an excessive reliance on others for emotional relief may reinforce these dysfunctional regulatory patterns over time (Hofmann, 2014).

Expanding on these findings, several empirical studies have emphasized that soothing can be maladaptive, particularly when used excessively (Barthel et al., 2018; Hofmann, 2014). For instance, Chan and Rawana (2021) reported that greater engagement in soothing is

significantly linked with higher internalizing symptoms and lower well-being. Similarly, research has shown that individuals who frequently use the soothing strategy tend to report greater psychological difficulties on self-reported measures (Messina et al., 2021). Akkuş, Peker, and Gökdağ (2024) conducted a longitudinal study to investigate whether IER leads to difficulties in intrapersonal emotion regulation. Although their hypothesis was not supported, they found a positive correlation between soothing and both intrapersonal emotion regulation and psychological distress (e.g., depression, anxiety, and stress).

However, Messina, Maniglio, and Spataro (2023) argued that it is not the frequency of IER strategies that predicts emotional health, but rather the quality and contextual appropriateness of their use. Supporting this view, Gökdağ (2021) found a significant association between soothing and perceived social support. This finding indicates that the presence of supportive others can promote emotional coping, and the effectiveness of soothing may be closely linked to the context in which it is employed, especially within collectivistic cultures. Furthermore, Ray-Yol et al. (2022) proposed that soothing may serve an adaptive function only when individuals do not engage in maladaptive cognitive strategies, such as rumination or catastrophizing.

Given that both Gökdağ (2021) and Ray-Yol et al. (2022) conducted their studies with Turkish samples, the influence of cultural context on IER strategies should not be overlooked. Collectivistic cultures, such as Turkish and Iranian societies, typically value emotional interdependence and interpersonal closeness, unlike individualistic cultures, which promote autonomy and self-regulation (Kagitcibasi, 2017). In this regard, soothing may represent an emotion regulation strategy culturally congruent with collectivistic norms, enhancing its effectiveness in such contexts (Liddell & Williams, 2019). These findings indicate that the adaptiveness of the soothing strategy is context-dependent, varying according to factors such as relationship quality, cultural norms, individual cognitive tendencies, and the level of emotional attunement with support figures.

In addition, previous research has demonstrated that the effectiveness of supportive communication depends not only on verbal content but also on nonverbal cues, which play a significant role in emotion regulation. Among these cues, prosody refers to variations in vocal features such as pitch, volume, rhythm, and speed (Cutler, Dahan, & Donselaar, 1997). It is particularly important for conveying emotional meaning (Akçay & Oğuz, 2020). For instance,

higher pitch levels have been associated with increased arousal (Mauss & and Robinson, 2009). Furthermore, studies suggest that vocal characteristics can influence others' emotion perception and behaviors (Bachorowski & Owren, 2008; Ko, Sadler, & Galinsky, 2015). Supporting this, Costa et al. (2018) found that participants who received feedback in a calmer tone reported reduced anxiety levels. Consequently, variations in the emotional tone of voice can affect how speech is perceived, thereby impacting the effectiveness of social support (Mullennix et al., 2002).

Considering the contrasting data reported in empirical findings, it is important to examine the function of soothing within different regulatory contexts. While chronic or dependency-driven use of soothing may maintain or even exacerbate emotional distress (Hofmann, 2014; Barthel et al., 2018; Chan & Rawana, 2021), short-term and appropriately use of support can facilitate emotional recovery (Gökdağ, 2021; Ray-Yol et al., 2022). Moreover, beyond verbal content, nonverbal elements such as vocal tone significantly influence the perceived effectiveness of soothing (Bachorowski & Owren, 2008; Mullenix et al., 2002; Ko et al., 2015). In the present study, soothing was operationalized through brief audio recordings delivered in a calm voice, designed to simulate interpersonal comfort and examine its immediate physiological effects. This controlled approach allows for a more precise understanding of soothing's potential to promote emotional recovery following acute stress.

CHAPTER 3

IN-GROUP AND OUT-GROUP EFFECTS IN EMOTIONAL SUPPORT

3.1 Social Identity Theory

Emotional regulation is not only shaped by individual-level mechanisms but is also closely linked to the relationships individuals maintain with their social environments and group affiliations. Understanding how people regulate their emotions within these contexts requires a comprehensive examination of the psychological processes underlying group membership and social identity. Group membership provides a critical social framework that influences both emotional experiences and their expression. In this regard, individuals' perceived group affiliations, their emotional responses toward these groups, and the regulation of such responses have significant implications at both the individual and societal levels.

To understand the influence of social factors on emotional and interpersonal processes, it is essential to engage with the social identity theory, originally developed by Tajfel and Turner (1979). According to this theory, individuals tend to categorize themselves and others into social groups, such as those based on nationality, religion, or social class, and these categorizations shape emotional responses, perceptions, and interactions both within and across group boundaries. Tajfel and Turner (1979) emphasized that social interactions lie on a continuum from interpersonal to intergroup. In an intergroup interaction, individuals see themselves not as unique individuals but as representatives of their groups, with personal traits are suppressed under the dominance of group identity (Hornsey, 2008). It is suggested that a shift from interpersonal to intergroup interactions affects how individuals perceive themselves and others (Tajfel & Turner, 1979).

The social identity theory proposes three different terms for explaining how individuals form and maintain group-based identities: social categorization, social identification and social comparison. Individuals tend to classify themselves and others based on several group-related characteristics (Tajfel & Turner, 1979). When category distinctions are highly visible, people likely to perceptually reinforce the idea of "we are the same" for the similar traits within the group and enhance the idea of "we are different from them" for the different traits among groups (Hornshey, 2008). Once people perceive themselves as a member of a particular group, they begin to internalize the group's norms, values, and behaviors of the group, a process

known as social identification (Hogg, 2010). They adjust their thoughts and behaviors to align with what it means to be a prototypical group member.

Building on social identity theory, self-categorization theory (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987) further explains how and why individuals identify themselves as group members and behave accordingly. According to this theory, *personal identity* refers to the qualities that make people unique as individuals, such as personal experiences, traits, talents and values (Turner et all., 1987). It highlights individuality and the distinct aspects of self that differentiate one person from another. On the other hand, *social identity* refers to the part of self-concept that originates from memberships in social groups. It reflects a shared identity with others in a group that holds emotional significance (Jones, Dovidio & Vietze, 2014). Social identity theory posits that individuals are motivated to identify with groups that enhance their self-concept in a positive way (Tajfel & Turner, 1979).

After categorizing themselves and identifying with a particular group, individuals typically engaged in comparison with other groups. These comparisons are often biased in favor of their own group, giving rise to in-group favoritism. In this context, "in-group" is the group with which individuals feel a sense of belonging to, where as the "out-group" comprises those groups with which they do not identify (Jones et al., 2014). Self-categorization theory suggests that conforming to in-group members, as opposed to our-group members, offers several strengths including a sense of belonging and enhanced self-esteem (Tajfel & Turner, 1979; Turner et al., 1987). Consequently, individuals are more likely to perceive, evaluate and behave more positively toward members of their in-group than those of out-group (Cikara & Van Bavel, 2014; Hewstone, Rubin & Willis, 2002).

3.2 Intergroup Emotions

Intergroup emotions theory (Mackie et al., 2000; Smith, 1993) posits that individuals experience emotions not only as personal responses but also as group members, with emotions shaped by their social identity and group affiliations. These intergroup emotions support individuals' motivation for positive self-evaluation and serve to reinforce group boundaries (Goldenberg et al., 2016). Emotions arising from group memberships strengthen ingroup cohesion and foster cooperation, while simultaneously creating emotional distance from outgroups (Suri, Leslie, & Gross, 2015).

The salience and nature of these group-based emotions are largely determined by how individuals categorize themselves within a given social context. Expanding on social identity and self-categorization theories, Intergroup Emotions Theory emphasizes the role of self-categorization in shaping emotional responses toward other groups (Goldernberg et al., 2016; Mackie, Smith, & Ray, 2008). The theory suggests that one person's emotional reactions to outgroups can vary depending on situationally induced shifts in self-categorization. In other words, the way a person defines themselves in a given context can significantly influence how they emotionally perceive and respond to members of other groups.

Supporting this claim, Ray et al. (2008) conducted a study with an American sample in which participants categorized themselves either as "Americans" or as "students". Participants then reported their level of anger and respect towards two out-groups: Muslims and police officers. The findings revealed that in response to Muslims, participants expressed more anger and less respect when categorized as Americans than when categorized as students. Conversely, in response to police officers, participants reported less anger and more respect when categorized as Americans than when categorized as students. These results highlight how shifts in self-categorization can shape the emotional responses individuals express toward different outgroups.

Moreover, research has shown that emotional alignment within a group can enhance social identification: when individuals perceive emotional similarity with others, they tend to feel a stronger sense of shared identity (Livingstone et al., 2011). Sharing affiliative emotions in interpersonal or group contexts further reinforces the in-group bond, fostering greater closeness, intimacy, and positivity in relationships. Such emotional alignment may also give rise to emotional transference, convergence, or contagion (Hatfield, Cacioppo, & Rapson, 1992; Parkinson & and Simons, 2012). Therefore, emotions serve important social functions, not only shaping how individuals relate to their in-group, but also influencing interpersonal and intergroup dynamics through these affective processes (Suri et al., 2015).

3.3 The Role of In-Group Dynamics in Emotion Regulation

As mentioned in previous sections, individuals generally show a preference for their in-groups over out-groups, which helps them to maintain a positive and coherent social identity. This preferential bias is reflected in a wide range of cognitive, emotional, and behavioral tendencies that shape how people perceive and interact with others. Typically, people feel

greater emotional closeness to in-group members, value their lives more, and pay greater attention to information about them compared to out-group members (Dovidio & Gaertner, 2010). These perceptions lead individuals to approach in-group members, being more helpful, cooperative, and generous with them, while often avoiding or keeping their distance from those outside their group (Jones et al., 2014). In addition, in-group affiliation helps to reduce feelings of loneliness by providing social support and promoting a sense of community and belonging (Galliher et al., 2011; Rivas-Drake, 2012).

Individuals are usually more influenced by the thoughts of in-group members than out-group members, as they tend to feel more similar to them and place greater trust in their opinions (Vaes, Paladino, & Leyens, 2006; Li, Qu & Telzer, 2018). This sense of similarity fosters openness and stronger emotional and social connections within the group (Chang & Yoon, 2011). Confirming group norms and sharing similarities with in-group members can provide adaptive advantages, since such alignment may increase access to resources and protection, which are crucial for survival (Vaes et al., 2006). Experimental studies have also shown that racial and ethnic in-group similarity can reduce anxiety and other negative emotions during interpersonal interactions (Roberts & Burleson, 2013; Soto et al., 2012).

Secondary emotions, such as compassion, guilt, and pride, enhance stronger interpersonal bonds more when expressed by in-group members (Vaes et al., 2004; 2006). Unlike primary emotions, which are basic and automatic responses shared universally, secondary emotions are more complex and arise from self-awareness and social evaluation (Leyens et al., 2000). These emotions are learned and shaped through social norms and cultural context, making them relevant in regulating social evaluation. As demonstrated by Vaes et al. (2003), people are more inclined to approach in-group members and avoid out-group members when responses involve secondary emotions.

Neuroscientific research has also provided further evidence for the role of social identity in emotional processing. For instance, in a laboratory study, Li, Qu, and Telzer (2018) examined how in-group and out-group influence emotional responses at both behavioral and neural levels. Participants first rated emotionally evocative images and later, during an fMRI scan, they were asked to re-evaluate the pictures after being informed about how in-group and out-group members rated them. The results showed that participants significantly adjusted their emotional ratings to align with in-group members compared to out-group members. This behavioral change was accompanied by increased activation in neural regions associated with

reward valuation (ventral striatum, ventromedial prefrontal cortex), mentalizing (dorsomedial and medial prefrontal cortices, posterior superior temporal sulcus, and temporal pole), and emotion and salience processing (amygdala and insula). Additionally, Vollberg and Cikara (2018) reviewed neuroimaging findings demonstrating that individuals consistently exhibit stronger empathic neural responses, particularly in the anterior insula and anterior cingulate cortex, when observing in-group members in distress compared to out-group members.

3.4 The Role of Out-Group Bias

Categorization of individuals into in-groups and out-groups often leads to cognitive biases such as exaggerating differences between groups, perceiving out-group members as more homogenous, and even dehumanizing them (Dovidio & Gaertner, 2010; Jones et al., 2014). Moreover, individuals tend to believe that in-group members share similar attitudes and values, whereas out-group members hold contrasting or opposing views, which further reinforces intergroup divides and conflict. The perception of out-group members and their emotions is influenced by these cognitive biases and stereotypes, often resulting in distorted and negatively biased interpretations (Mackie & Smith, 2018). Research suggests that even at the perceptual level, emotional expressions displayed by out-group members are more likely to be interpreted as indicative of negative emotions compared to those of in-group members (Lazerus et al., 2016). Moreover, it has been demonstrated that in-group members tend to attribute subtle and complex emotions, often described as “uniquely human”, such as regret and compassion, to themselves, whereas out-group members are more often perceived as experiencing only basic or primary emotions like fear and anger (Leyens et al., 2000).

Building on these findings, Seger, Mackie & Smith (2009) investigated how individuals estimate the emotions of out-group members. In their study, participants reported their own emotions and also estimated the emotions of out-group members. For example, men reported how they felt as men, and they estimated how women felt as women; a similar procedure was applied to political groups such as Democrats and Republicans. The results showed that while the estimates of out-group emotions were generally accurate, they were influenced by two biases: projection and in-group positivity bias. Projection is the tendency of in-group members to assume out-group members feel similarly to themselves to some extent, while in-group positivity bias leads people to believe that out-group members experience more negative and less positive emotions compared to their group (Mackie & Smith, 2018).

Moons, Chen, and Mackie (2017) further investigated the influence of emotion stereotypes in specific contexts by asking White participants to predict the emotional responses of White or Black American males to various positive and negative scenarios (e,g,, receiving feedback, facing insults or praise, and losing or finding money). The findings revealed that group-based emotion stereotypes affected these predictions. White participants expected Black American males to exhibit greater anger in response to negative events compared to White males.

Neuroimaging research provides additional evidence for emotionally biased responses toward out-groups. In a study conducted by Rilling and colleagues (2008), individuals who exhibited greater behavioral discrimination against out-group partners also demonstrated increased activation in the frontoinsular cortex during interactions with those partners. This heightened neural response suggests that such interactions can be experienced as emotionally arousing and potentially aversive. The authors suggest that the differences between in-group and out-group interactions may represent the underlying biological mechanism that contributes to human tendency to identify more with in-group members, while fostering distrust, fear, and discriminatory behavior toward out-group members (Rilling et al., 2008).

Importantly, these perceptual, cognitive, and neural biases influence not only the perception of out-group emotions but also how these emotions impact the emotional states of in-group members. The emotional impact of out-group expressions is context-dependent (Hess & Fischer, 2014). For example, in cooperative settings, encountering a happy out-member can evoke shared feelings of joy and satisfaction. However, in the context of intergroup rivalry or competition, observing the same positive emotion may trigger feelings of anxiety, threat, or anger within the in-group (Mackie & Smith, 2018). This context-dependent nature of emotional responses highlights the complexity of intergroup dynamics and underscores the importance of situational factors in understanding the role of out-group biases.

CHAPTER 4

METHOD

4.1 Objectives and Hypotheses

The present study aimed to assess whether, and to what extent, vocal support from others can function as an effective strategy for regulating distress. Specifically, we examined potential differences in interpersonal emotion regulation depending on whether the support was delivered in the participant's native language (in-group) or a foreign language (out-group).

We first aimed to establish whether the stress induction paradigm was effective. Specifically:

1. Does exposure to distressing visual stimuli combined with cognitive tasks lead to a measurable increase in heart rate, indicating the activation of a stress response?

As is known from the literature on stress response, acute stress activates the sympathetic nervous system, resulting in elevated heart rate (Thayer & Friedman, 2002; Giannakakis et al., 2019; Henning & Krawiec, 2023). Furthermore, studies demonstrated that stress induction protocols such as the Mannheim Multicomponent Stress Test (MMST) and the International Affective Picture System (IAPS) effectively increase heart rate (Ferreira, 2019; Lang et al., 2008; Kolotylova et al., 2009). Therefore, we expect that exposure to the stress paradigm (i.e., distressing visual stimuli combined with cognitive tasks) will result in a significant increase in heart rate, indicating physiological stress activation.

Next, we aimed to examine the physiological recovery phase by asking:

2. Does soothing vocal support delivered in the participant's native language (in-group support) lead to greater reduction in heart rate compared to vocal support delivered in a foreign language (out-group support) or to silence (intrapersonal emotion regulation)?

Previous research on stress recovery highlights the critical role of parasympathetic nervous system activation in promoting physiological recovery following an acute stress response (Porges, 1995; Wehrwein et al., 2016). Additionally, empirical findings suggest that interpersonal emotion regulation strategies, such as soothing through supportive communication, can effectively facilitate both emotional and psychological recovery (Coan & Sbarra, 2015; Gökdağ, 2021; Williams et al., 2018). Building on theoretical models including the social identity approach (Tajfel & Turner, 1979; Turner et al., 1987) and the intergroup

emotion framework (Mackie et al., 2000), vocal support delivered in the participants' native language (i.e., in-group condition) is believed to enhance perceptions of emotional similarity and interpersonal alignment (Vaes et al., 2006), thereby enabling more effective parasympathetic regulation (Parkinson & and Simons, 2012; Suri et al., 2015). Therefore, we hypothesize that in-group soothing will lead to significantly greater heart rate reduction compared to out-group soothing or silence conditions.

Finally, we investigated the moderating role of interpersonal emotion regulation strategies in this process.

3. To what extent does the use of interpersonal emotion regulation strategies (as measured by the "*Soothing*" subscale of the IERQ) moderate the relationship between soothing audio conditions (in-group, out-group, silence) and heart rate recovery?

Existing research indicates that the effectiveness of interpersonal emotion regulation (IER) strategies, such as soothing, depends not only on their frequency of use but also by their contextual appropriateness and quality (Messina et al., 2023). While excessive or dependency-driven use of soothing may maintain or exacerbate emotional distress (Hofmann, 2014; Barthel et al., 2018; Chan & Rawana, 2021), short-term and contextual appropriate support, especially during acute stress, can promote physiological and emotional recovery (Gökdağ, 2021; Ray-Yol et al., 2022). Prior studies suggest that individuals who frequently engage in soothing behaviors tend to report greater perceived social support and derive more benefit from interpersonal regulation strategies, especially in collectivist cultures that reinforce such behaviors (Gökdağ, 2021; Liddell & Williams, 2019; Kagitcibasi, 2007). Therefore, we hypothesize that participants with higher *Soothing* scores will exhibit greater heart rate recovery following in-group vocal support, compared to those with lower Soothing scores and/or those in out-group and silence conditions.

4.2 Participants

A total of 99 participants took part in the study, including 55 males (55.6%) and 44 females (44.4%). Participants' ages ranged from 18 to 35 years (M = *24.42*, SD = *4.44*). In terms of nationality, 58 participants (58.6%) were from Turkey and 41 (41.4%) from Iran. All participants reported an average socioeconomic status.

4.3 Procedure

The present study is structured in two steps: an online survey and an experimental task conducted in the laboratory.

Initially, an announcement was shared on social media platforms to invite participants to take part in the study. Participants showing interest were then contacted via email. The email provided the consent form, the online survey, and essential information about the experimental procedure. The consent form included an explanation of the study's purpose, the estimated time required to complete the online questionnaire, and instructions for responding, highlighting that participation was voluntary.

Due to the sensitivity of heart rate measurement to various stimuli (Laborde, Mosley & Thayer, 2017), participants were provided with detailed information about the experimental procedure. They were asked to avoid coffee and smoking for 12 hours prior to the session to minimize external influences on heart rate measurement. They were advised to wear comfortable clothes to facilitate electrode placement. Additionally, participants were asked to notify the researchers if they were currently taking any special medication or had been diagnosed with a heart condition, as these factors could potentially affect the results. The email contained the laboratory's location, along with a reminder of the scheduled appointment date and time.

4.3.1 Online Survey

The online survey questions were created using Qualtrics. Before attending the experiment, participants completed a socio-demographic form, the Emotion Regulation Questionnaire (ERQ), and the Interpersonal Emotion Questionnaire (IERQ) online.

4.3.2 Experimental Task

Upon arriving at the laboratory, participants were asked to complete a checklist designed to assess their eligibility based on the study's exclusion criteria. Subsequently, participants were provided with a detailed briefing on the procedure and the sequence of the tasks to be performed during the experimental part. To record physiological responses, an electrode belt was placed on their chest, ensuring direct contact with the skin. Participants were seated in a way that only the computer screen was visible to them to minimize any potential external distractions. Given the high sensitivity of heart rate recordings to movement, they were

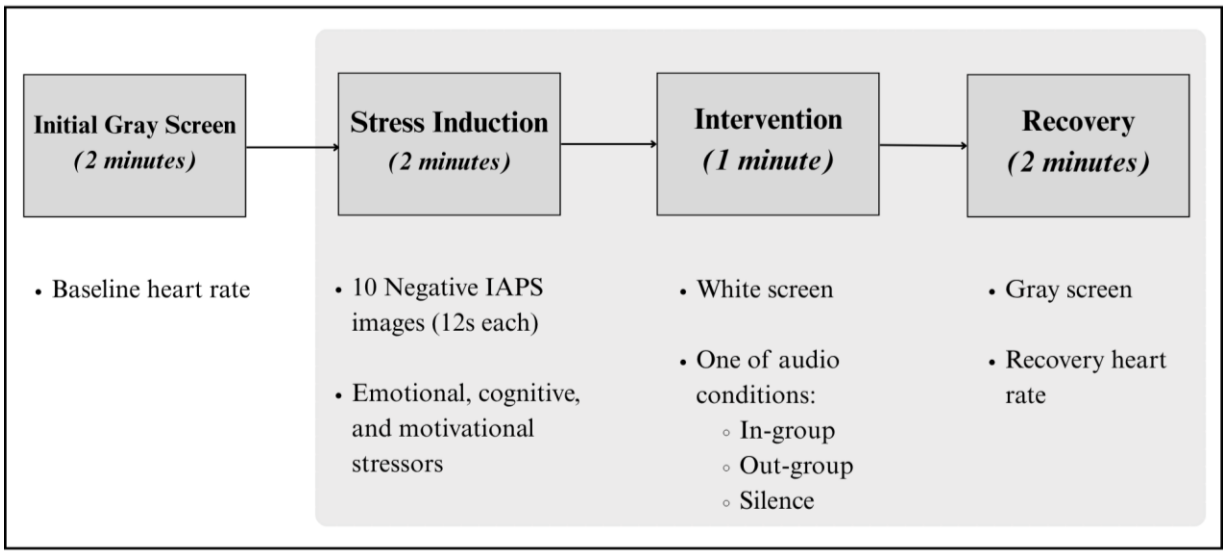
requested to sit comfortably and remain still throughout the experiment to avoid recordings being affected.

Baseline Video.

A 5-minute relaxing video was presented on the computer screen while participants' physiological data were recorded to establish baseline heart rate data. Participants were provided headphones, with the audio level standardized for all individuals to ensure consistency. Following the completion of the baseline recording, participants were informed about the next task.

Figure 4

The Procedure of the Interpersonal Emotion Regulation Task



Note. After the initial gray screen, stress induction, intervention and recovery phases were repeated three times. Audio condition (in-group, outgroup, silence) was randomized across repetitions.

Interpersonal Emotion Regulation Task.

Participants watched a 17-minute video on the computer while their physiological responses were continuously recorded. The task was divided into three phases: stress induction, intervention, and recovery. The stress induction phase included the presentation of pictorial slides, the intervention phase displayed white slides with three different audio conditions: ingroup, outgroup, and control. Finally, the recovery phase consisted of a gray screen. This sequence was repeated three times throughout the task, and participants experienced a different

audio condition for each repetition. The order of the three audio conditions was balanced and randomized. Figure 4 illustrates the experimental procedure.

A) Stress Induction

The task started with an initial gray slide to ensure the presence of a baseline right before the task (from which participants' delta scores were computed). Participants were instructed to focus on the screen and sit still to ensure heart rate recordings.

After the initial gray screen, multiple stressor modalities (e.g., emotional, cognitive and motivational performance stressors) were applied simultaneously to induce a greater stress response. The stress induction phase was structured to last two minutes for each repetition.

Specifically, for emotional stressors, participants were exposed to a set of negative highly arousing affective pictorial slides extracted from the IAPS dataset. Each pictorial set consisted of 10 images, with each image displayed on the screen for 12 seconds. In total, 30 different images were used throughout the study, and they were shown only once. All images used in the study were taken from the International Affective Picture System (IAPS, Lang et al., 2005), a validated database widely used in research for eliciting emotional responses.

For cognitive stressor, a mathematical computational task was used. The negative affective images were specifically designed to include various numbers. Participants were asked to carefully examine each image while simultaneously identifying the numbers displayed. As part of the task, they were instructed to add these numbers cumulatively and keep a continuous total as they moved through the images.

For motivational performance stressor, the participants were required to verbally express the cumulative sum in front of the researcher immediately after adding the numbers for each image. This added an extra level of difficulty, as participants needed to perform both processing of the mathematical computation and the communicating of the results while under time pressure.

B) Intervention

Following the stress exposure, participants were shown white slides for one minute. During this phase, they were instructed to look at the screen and try to relax while paying

attention to the audio they heard. The white slides corresponded to three different audio conditions: *in-group*, *out-group,* and *control*.

In the in-group condition, participants listened to the audio in their native language—Turkish participants listened to Turkish audio while Iranian participants were listened to Persian audio. In the out-group condition, all participants presented with the same audio content, however, it was translated into a foreign language, in Italian. Lastly, in the control condition, no audio was presented.

The audio scripts consisted of soothing messages that aimed to help participants to regulate their emotions. The script of the audio was created ad hoc for the study. It was initially written in English, and then translated into Turkish, Persian, and Italian. The recording was performed by six native speakers (three female and three male). During the task, female participants listened to female-voiced audio, while male participants listened to male-voiced versions.

The soothing audio texts are as follows:

- *Turkish Text (In-group condition for Turkish speakers)*

"Merhaba, ismim (...). Şu anda duygusal olarak zorlandığını görebiliyorum. Senin için burada olduğumu bilmeni isterim. Şu an olumsuz duygular hissediyor olabilirsin, bu çok normal. Tamamladığın görevin çok stresli olduğunu biliyorum. Ama sen bunu bitirecek kadar cesurdun. Çoğu insan bu kısmı tamamlarken çok stres oluyor. Harika bir iş çıkardın ve kendinle gurur duymalısın. Eğer kendini rahat hissedersen, çalışma bittiğinde seni en çok rahatsız edenin ne olduğunu duymak isteriz. Seni yargılamadan dinlemek ve elimizden gelen her türlü desteği sunmak için buradayız. Eğer bu deneyimin hakkında konuşmak istemezsen de, bu hiç sorun değil. Duygularına saygı duyduğumuzu ve seni önemsediğimizi bilmeni isteriz. Bazen, zor zamanlarda, yanımızda birinin olduğunu bilmek bile bize iyi gelir. Ve ben senin için buradayım. Bu süre içerisinde rahatla ve iyi bir iş çıkardığını hatırla. Seninle gurur duyuyorum."

- *Persian Text (In-group condition for Persian speakers)*

سلام من علی هستم، این طور به نظر میاد که در شرایط سختی هستی. من می خوام که تو بدونی که من به خاطر کمک به تو اینجام. تجربه کردن احساسات الانت اصلا اشکالی نداره. نیازی نیست که به تنهایی با اون ها روبرو بشی. من

میدونم که این تمرین خیلی استرس آور بود. تو شجاع هستی که اون رو انجام دادی. بیشتر مردم وقتی با این تمرین مواجه می شوند، بیش از حد مضطرب می شوند. و این خیلی طبیعیه که تو این احساسات منفی تجربه کنی. حالا همه چیز تموم شده و خیلی سریع تو به حالت قبلیت برمی گردی. و دوباره احساس آرامش میکنی. تو کار خیلی بزرگی انجام دادی. و باید به خودت افتخار کنی. فقط این بدون این احساسات طبیعی هستند. و تو برای من مهم هستی بعضی وقت ها این کمک کننده هست که کسی کنارمون باشه و بهم مون کمک بکنه. اگه چیزی نیاز داری یا اگه راهی وجود داره که من میتونم کمکت کنم حتما به من بگو. تو این لحظه آروم باشه و به خاطر داشته باش که تو کار بزرگی انجام دادی. و تو یک فرد خارق العاده هستی و من بهت افتخار میکنم.

- *Italian Text (Out-group condition for both Turkish and Persian speakers)*

"Ciao, sono (…), mi sembra che tu stia attraversando un momento difficile, e voglio che tu sappia che sono qui per te. Va bene sentirsi come ti senti, e non devi affrontare tutto da solo. So che il compito è stato molto stressante. Sei stato coraggioso a portarlo a termine; molte persone si stressano molto quando affrontano questo tipo di compiti, ed è normale provare emozioni negative. Ora è finito, e presto ti riprenderai e tornerai a sentirti calmo. Hai fatto un ottimo lavoro, e dovresti essere molto fiero di te. Se ti senti a tuo agio, una volta che tutto è finito, ci piacerebbe sapere qual è stata la cosa più brutta. Siamo qui per ascoltare senza giudicare e offrire qualsiasi tipo di supporto possiamo. Se non vuoi parlarne, va bene lo stesso. Sappi solo che i tuoi sentimenti sono validi e ci importa di te. A volte, aiuta avere qualcuno al tuo fianco. E io sono qui per te. Se c'è qualcosa di specifico di cui hai bisogno o se c'è un modo in cui possiamo aiutare, per favore fammelo sapere. Nel frattempo, rilassati e ricorda che hai fatto un ottimo lavoro; sei una persona fantastica e hai dimostrato di saper affrontare compiti impegnativi. Sono orgoglioso di te, e sono qui per te."

C) Recovery

After the white slides, participants were presented with gray slides lasting two minutes. This phase was designed to measure participants' recovery heart rate data after exposing themselves to the stress-inducing stimuli and the soothing audio conditions.

4.4 Measures

The online survey included a socio-demographic form as well as measures of emotion regulation and interpersonal emotion regulation. The questionnaires selected in the study were originally developed in English. In the present study, the Turkish and Persian adaptations of

the instruments were used. Moreover, the participants were asked to answer the Checklist Form before starting the experimental task.

4.4.1 Socio-demographic form

The form was developed by the researcher to align with the needs of the study. Participants were asked to provide personal information, including age, gender, place of birth, place of residence, religiosity, and perceived socio-economic status. In addition, they were asked to indicate the extent of their identification with the Turkish and Italian communities, as well as their level of trust in these governments.

4.4.2 Emotion Regulation Questionnaire (ERQ)

The Emotion Regulation Questionnaire was developed by Gross and John (2003). This self-report measure includes 10 items and uses a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The ERQ is designed to measure how individuals show differences in using emotion regulation strategies. The scale consisted of two dimensions, cognitive reappraisal and expressive suppression. The cognitive reappraisal dimension evaluates individuals' ability to regulate their emotions by changing their thoughts. On the other hand, the expressive suppression dimension assesses an individual's ability to hide their positive or negative emotions from others. The cognitive reappraisal dimension includes 6 items (e.g., "When I want to feel less negative emotion, I change the way I'm thinking about the situation") and the expressive suppression dimension includes 4 items (e.g., "I control my emotions by not expressing them"). The internal consistency for the cognitive reappraisal dimension was reported as .79 and for the expressive suppression dimension, it was .73. The test-retest reliability coefficient, measured over three months, was found to be .69 (Gross & John, 2003).

The Turkish adaptation of the Emotion Regulation Questionnaire was conducted by (Yurtsever, 2004). The internal consistency coefficients were calculated as .85 for the cognitive reappraisal dimension and .78 for the expressive suppression. Test-retest reliability was assessed through measurements taken four weeks apart, with the test-retest correlation coefficients stated as .88 for the cognitive reappraisal dimension and .82 for the expressive suppression dimension (Yurtsever, 2004).

The psychometric properties of the Persian version of the ERQ were carried out by Foroughi et al. (2021). The Cronbach's alpha coefficients were reported as .76 for the cognitive reappraisal dimension and .72 for the expressive suppression dimension, with item 9 excluded (Foroughi et al., 2021).

4.4.3 Interpersonal Emotion Regulation Questionnaire (IERQ)

The Interpersonal Emotion Regulation Questionnaire was developed by Hofmann et al. (2016) to measure emotion regulation in interpersonal relationships. The scale includes 20 items with four factors that consist of 5 items each. The dimensions are enhancing positive affect (*"I like being around others when I'm excited to share my joy"*), perspective taking (*"Having people telling me not to worry can calm me down when I am anxious"*), soothing (*"I look for other people to offer me compassion when I'm upset"*), and social modeling ("*Seeing how others would handle the same situation helps me when I am frustrated*"). It is a 5-point Likert scale, ranging from 1 (not true for me at all) to 5 (extremely true for me). Higher scores in each dimension indicate greater use of those types of interpersonal emotion regulation strategies. Total scores for each dimension are calculated by summing up the items associated with that dimension. Hofmann et al. (2016) reported good reliability with Cronbach's alpha scores of .89 for enhancing positive affect, .91 for perspective taking, .94 for soothing, and .93 for social modeling.

The Turkish adaptation of the Interpersonal Emotion Regulation Questionnaire has been conducted in multiple studies (Koç et al., 2019; Sarisoy, 2017; Gökdağ et al., 2019, Saruhan, Başman & Ekşi, 2019; Malkoç et al., 2018). The present study used Koç et al.'s (2019) adaptation. Koç et al. (2019) stated a high internal consistency score for the overall scale, with a Cronbach's alpha of .90. Furthermore, the Cronbach alpha values for subscales were found to be .81 for enhancing positive affect, .77 for perspective taking, .86 for soothing, and .87 for social modeling. The test-retest reliability of the adaptation ranged from .58 to .76 for the subscales.

The adaptation of the IERQ for the Persian-speaking population was done by Soleimani, Mofrad, and Kareshki (2016). The internal consistency of the study was reported as .88. The Cronbach's alpha values for subscales measured as .74 for enhancing positive affect, .73 for perspective taking, .77 for soothing, and .70 for social modeling (Soleimani, Mofrad &Kareshki, 2016).

4.4.4 Checklist Form

Participants had been informed in advance via email, which provided detailed instructions on what to avoid before attending the experiment. The Checklist Form contained six questions (see Table 1) related to the exclusion criteria for HR recordings. Participants were asked to complete these questions before starting the experimental task to confirm their suitability for the recordings.

Table 1

Checklist Form Questions

1. Have you consumed any food or beverages within the last 2 hours?
2. Have you had any caffeinated beverages such as coffee, tea, or energy drinks in the last 2 hours?
3. Have you consumed alcohol within the last 24 hours?
4. How many hours of sleep did you get last night?
5. Have you used any prescription medications in the past 24 hours? If so, what are they?
6. Did you smoke tobacco or use nicotine-containing products within the last 2 hours?

Note. Participants responded to each item with either "Yes" or "No."

4.5 Data-Analysis Plan

Data were preliminarily screened data for outliers and missing values. In addition, we will assess normality assumptions for all variables using histograms and Shapiro–Wilk tests. Subsequently in order to answer our research questions we will:

1) Conduct a paired-samples t-test to compare heart rate between baseline and the stress phase (S1) to confirm stress induction.
2) Compute paired-samples t-tests to assess heart rate changes from stress phase (S1) to post-stress phase (mean_hr2) within each condition (in_group, out_group, controllo).
3) Create a difference score (voice = mean_hr2 – S1) as the dependent variable in order to run a linear regression with condition, gender, age, and country as predictors of voice. Evaluate model significance (F-test), R^2, and individual predictor contributions (t-tests).
4) Extend the regression model by including soothing and its interaction with condition and examine main effects and interaction terms to determine moderating effects of soothing.

CHAPTER 5

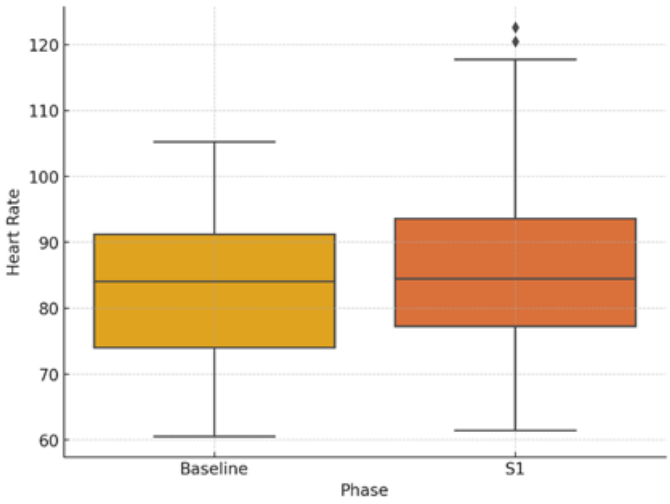
RESULTS

5.1 Effectiveness of the Stress Induction Procedure

To verify the effectiveness of the stress induction procedure, we conducted a paired-samples t-test comparing participants' heart rate during the baseline phase and the stress induction phase (S1). The results revealed a statistically significant increase in heart rate from baseline (M = 83.26, SD = 10.98) to S1 (M = 85.76, SD = 12.69), $t(98) = 4.00$, $p < .001$, as illustrated in Figure 5. These findings confirm that experimental manipulation successfully elicited a physiological stress response, thereby supporting the validity of the S1 phase as a reliable and effective stress-inducing component within the study protocol.

Figure 5

Comparison of Heart Rate Baseline and Stress Induction (S1)

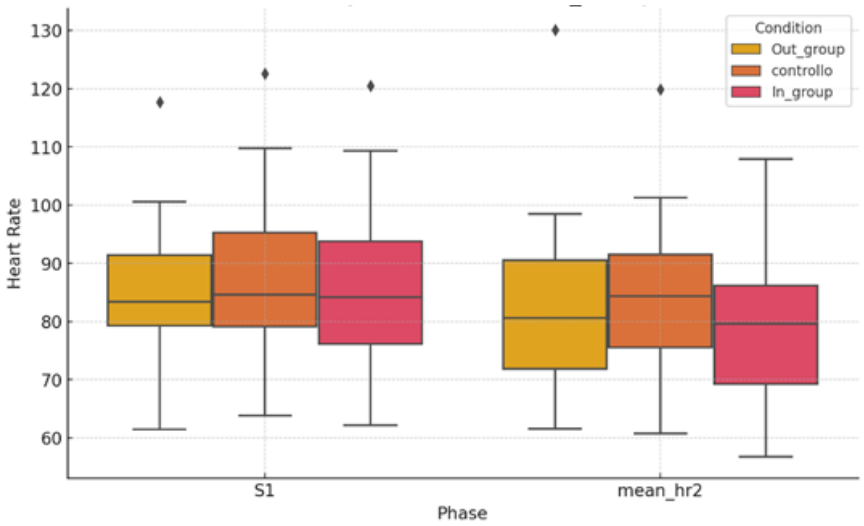


5.2 Effect of the Soothing Audio

To examine physiological recovery following the stress phase, and the regulatory effect of the soothing audio, we compared heart rate during the stress induction phase (S1) and the subsequent post-stress phase (mean_hr2) within each experimental condition using paired-samples t-tests. Significant reductions in heart rate were observed across all three conditions, indicating a general recovery effect.

Figure 6

Heart Rate Change from Stress Induction (S1) to Post-Stress (mean_hr2)



As shown in Figure 6, in the in_group condition, heart rate significantly decreased from $M = 85.70$, $SD = 13.19$ to $M = 80.02$, $SD = 12.87$, $t(35) = –9.82$, $p < .001$. In the controllo condition, heart rate declined from $M = 85.64$, $SD = 13.20$ to $M = 83.36$, $SD = 12.63$, $t(39) = –3.33$, $p = .002$. Similarly, in the out_group condition, heart rate dropped from $M = 86.07$, $SD = 11.47$ to $M = 82.49$, $SD = 14.59$, $t(22) = –2.90$, $p = .008$. These results indicate a consistent and statistically significant downregulation of physiological arousal across all experimental conditions following the stress induction phase, with the in-group condition yielding the most pronounced reduction.

To explore whether demographic factors influenced physiological recovery, we computed the variable voice, defined as the difference between post-stress heart rate (mean_hr2) and heart rate during the stress phase (S1). We then fitted a linear regression model with voice as the dependent variable, and including condition, genderi age, and culture (country) as predictors. The model was statistically significant, $F(5, 93) = 2.70$, $p = .025$, $R^2 = .13$, indicating that the experimental condition was a significantly predicted post-stress heart rate change (see Table 2). Specifically, participants in the *controllo* condition showed significantly smaller decreases in heart rate compared to those in the *in_group* condition.

Table 2

Linear Regression Predicting Heart Rate Recovery ("Voice") from Condition, Gender, Country, and Age

Predictor	b	SE	t	p
Intercept	–10.70	3.90	–2.74	.007
Condition: Out-group	2.18	1.22	1.79	.077
Condition: Control	3.38	1.05	3.22	.002
Gender (Male = 1)	0.95	0.93	1.02	.310
Country (Turkey = 1)	1.22	1.09	1.12	.264
Age	0.15	0.13	1.16	.249

Note. N = 99. The reference category for the condition variable is the in-group condition.

5.3 The Role of Interpersonal Emotion Regulation

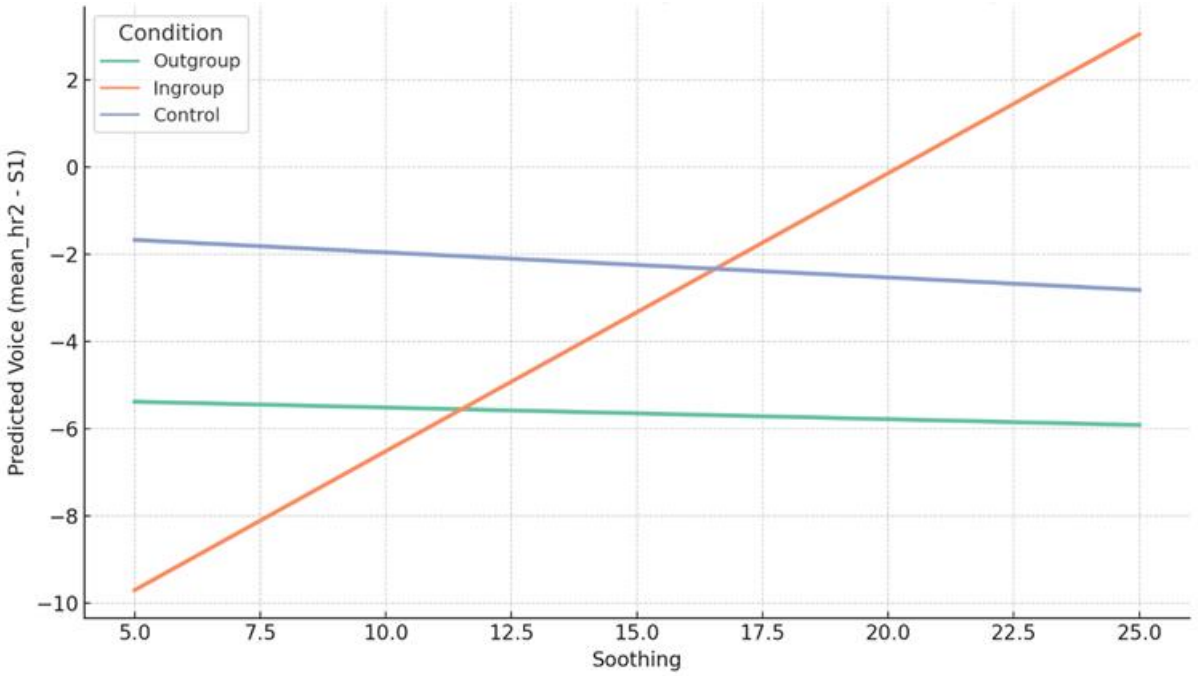
To investigate whether the effect of condition on post-stress heart rate change (*voice*) varied according to participants' use of the "Soothing" strategy form the Interpersonal Emotion Regulation Questionnaire, we included an interaction term between condition and soothing in a linear regression model. The model included condition, soothing, and their interaction as predictors. This approach allowed us to examine whether the relationship between soothing and physiological recovery differed across experimental conditions.

The regression results showed a significant negative effect of being in the in_group condition (b = –7.65, p = .048), indicating that participants in this condition experienced greater heart rate reduction compared to the reference group. Furthermore, the interaction between condition and soothing was significant for the in_group × soothing term (b = 0.66, p = .007), suggesting that the relationship between soothing and heart rate recovery varied depending on the experimental condition. The main effect of soothing alone was not statistically significant (p = .846), which implies that the use of soothing as an interpersonal strategy did not independently predict heart rate recovery.

To further validate these effects, an ANOVA was performed on the same regression model. The analysis revealed a significant main effect of condition (F(2, 93) = 5.98, p = .004) and a significant interaction between condition and soothing (F(2, 93) = 4.66, p = .012). However, the main effect of soothing alone was not significant (F(1, 93) = 1.39, p = .242).

Figure 7

Interaction of Condition and Soothing on Heart Rate Recovery (Voice)



Together, these findings underscore that the impact of soothing on heart rate recovery is not uniform across groups but rather depends on the experimental condition, with particularly pronounced effects observed in the in_group.

CHAPTER 6

DISCUSSION

The present study aimed to investigate the physiological effects of soothing vocal support on heart rate recovery following acute stress exposure, with a specific focus on the role of in-group versus out-group language and individual differences in interpersonal emotion regulation strategies. This chapter discusses the results in light of the study's three main objectives, integrating them with relevant theoretical frameworks and previous research.

6.1 Effectiveness of the Stress Induction Procedure

Preliminary we aimed to validate whether the experimental design successfully induced acute stress, as evidenced by physiological changes in heart rate. To achieve this, participants were exposed to the stress induction procedure that combined emotionally negative images from the International Affective Picture System (IAPS) with cognitively demanding arithmetic tasks and performance pressure. This multimodal approach aimed to stimulate a complex, real-world stressor by engaging both emotional and cognitive processes.

Our result confirmed that the experimental procedure was successful in inducing stress, as demonstrated by a significant increase in heart rate from the baseline level. This physiological change reflects the activation of the sympathetic nervous system (SNS), a core component of the body’s acute stress response (Ferreira, 2019). As prior research on stress response indicated, the SNS activation is associated with the secretion of hormones that lead to increased heart rate and blood pressure, as part of the body’s adaptive “fight-or-flight” response (Thayer & Friedman, 2002; Giannakakis et al., 2019). According to the neurovisceral integration model, this physiological response shows the involvement of the central autonomic network in responding to perceived threats (Thayer et al., 2012).

Additionally, these outcomes are in line with earlier studies using similar multimodal stress induction methods, such as the Mannheim Multicomponent Stress Test (Kashi et al., 2024; Kolotylova et al., 2010; Reinhardt et al., 2012). Moreover, previous research has demonstrated that IAPS images reliably evoke significant physiological and emotional arousal across cultures (Branco et al., 2023; Lang et al., 2008; Tok et al., 2010). The findings from the present study, based on Turkish and Iranian samples, further confirm the utility of IAPS as a culturally adaptable and standardized tool for stress induction.

In sum, this study reinforces existing evidence that heart rate is a reliable physiological indicator of stress reactivity (Giannakakis et al., 2019). As we hypothesized, the consistent increase in heart rate observed across participants suggests that the stress induction procedure was successful. Based on this validated stress response, we can proceed to examine the subsequent recovery processes.

6.2 Effect of Soothing Audio Support on Heart Rate Recovery

The main aim of the study is to examine the effect of a soothing voice (audio) on physiological recovery following stress exposure, and to determine whether the language of delivery (i.e., native language for in-group condition, foreign language for out-group condition) influenced the effectiveness of the support. Our results showed a consistent decrease in physiological arousal across all experimental conditions following the stress induction phase, demonstrating that the participants were able to downregulate their physiological arousal after experiencing stress.

Importantly, the extent of recovery varied depending on the condition, with the strongest reduction observed in the in-group condition. Supporting our hypothesis, participants who received soothing messages in their native language exhibited significantly greater reduction in heart rate compared to those who received the same messages in a foreign language or those who heard no soothing messages. These results suggest the potential regulatory advantage of receiving support from an ingroup member, especially during the recovery phase following stress.

This effect can be understood by considering theories that focus on the social nature of emotional experience and regulation. Emotion regulation often involves social interactions where individuals seek support, comfort, and validation from others to regulate themselves (Niven et al., 2009). In our study, the use of native language functioned as a social cue signaling in-group membership. According to Social Identity Theory (Tajfer & Turner, 1979), individuals are likely to evaluate and respond more positively to members of their own social group compared to out-group members (Cikara & Van Bavel, 2014). This in-group favoritism leads individuals to pay more attention to information coming from in-group members (Dovidio & Gaertner, 2010), behave more helpfully and cooperatively (Jones et al., 2014), and trust more in their thoughts and emotional expressions (Vaes, Paladino, & Leyens, 2006; Li, Qu, & Telzer, 2018). Consequently, our findings can be interpreted as receiving the audio from

in-group members may lead participants to experience stronger regulatory benefits due to perceived similarity, emotional alignment, and increased trust in the source of the message, all of which contributed to more effective downregulation. Conversely, the less pronounced out-group effect may be attributed to reduced emotional alignment, lower perceived closeness, and the influence of out-group bias (Mackie & Smith, 2018; Lazerus et al., 2016).

The regression analysis further revealed that the model significantly predicted heart rate recovery. Among the predictors, only the experimental condition had a significant effect, whereas demographic variables such as gender, age, and cultural background were not significant. This finding can be explained within the framework of interpersonal emotion regulation, which extends beyond intrapersonal processes to include social interactions where individuals regulate their emotions through engagement with others (Zaki & Williams, 2013). Accordingly, it is possible that shared group membership and social alignment played a more influential role in physiological recovery than individual demographic characteristics.

Moreover, the regression analysis indicated that participants in the control condition, who received no auditory support, showed significantly smaller decreases in heart rate compared to those in the in-group. This result aligns with the Social Baseline Theory (Coan Sbarra, 2015), which proposes that human brains have evolved to expect and benefit from social regulation of emotional states. In the context of our study, participants in the control condition may have had to depend only on their intrapersonal regulation strategies because of the absence of auditory support. However, our findings indicate that intrapersonal regulation was less effective than interpersonal regulation, as evidenced by the greater decline in heart rate observed in the in-group condition, where participants were supported with soothing messages in their native language. This supports the idea that interpersonal regulation can complement or compensate for intrapersonal regulation strategies, especially during the times of acute stress when individuals struggle to regulate emotions on their own (Marroquín, 2011).

It is important to mention that we observed considerable variability and the presence of outliers in heart rate responses during both the stress induction and recovery phases. This variability was expected, as individual differences in cardiovascular reactivity well-documented in the literature. Previous research has shown that autonomic nervous system functioning can differ across individuals (Berntson et al., 1997). Biological factors such as baseline vagal tone, baroreflex sensitivity, and cardiac autonomic flexibility can significantly affect how individuals physiologically respond to and recover from the stress (Thayer & Lane,

2000; Laborde, Mosley, & Thayer, 2017). Therefore, the variability observed in the present study can be attributed to these inherent biological differences rather than inconsistencies in the experimental procedure.

6.3 Moderating Role of Interpersonal Emotion Regulation

The final objective of our study was to investigate whether individual differences in the tendency to use interpersonal soothing, as measured by the "Soothing" subscale of the IERQ, would moderate the relationship between support condition and heart rate recovery. Accordingly, we hypothesized that participants with higher soothing scores would exhibit greater decline in heart rate following stress exposure compared to those with lower scores and/or those in the out-group and control conditions.

Our results revealed a significant interaction between experimental condition and the self-reported use of soothing. Specifically, participants who scored higher on the "Soothing" subscale of the IERQ exhibited greater physiological recovery in the in-group condition. In contrast, this benefit was not observed in the out-group or control conditions. This suggests that individuals who turn to others for emotional comfort may benefit more when that support comes from someone perceived as belonging to their own group. This is consistent with previous research indicating that individuals with a stronger reliance on social reassurance and emotional support show greater resilience in response to acute stressors (Marroquín, 2011).

Notably, we did not observe a significant main effect of soothing alone on heart rate recovery. This suggests that the soothing strategy alone may not be consistently effective in regulating physiological stress responses and contributing to heart rate reduction. Instead, its impact can be context-dependent. This aligns with earlier studies suggesting that a high reliance on interpersonal soothing may reflect a lack of confidence in one's coping abilities (Ray-Yol & Altan-Atalay, 2020) and be associated with increased emotion regulation difficulties (Koç et al., 2019). Other studies similarly linked habitual use of soothing strategies with poorer mental outcomes, including increased internalizing symptoms and emotional difficulties (Chan & Rawana, 2021; Hofmann, 2014; Messina et al., 2022). These findings suggest that the absence of a main effect for soothing in our study may be explained by the limited efficacy of the strategy when it is used on its own, without supportive contextual factors.

While these studies indicate that soothing may become maladaptive when overused or inappropriately (Hofmann, 2014), as also supported by our results, the impact of soothing likely

depends on the contextual factors. For example, Messina et al. (2023) pointed out that aspects such as the quality of the content and its fit with the situational context are more important than the frequency of use in determining the impact of the IER strategies. Consistent with this, research has shown that the benefits of soothing tend to increase in the presence of supportive others (Gökdağ, 2021). This may be helpful in explaining why, in our study, soothing was influential only in the in-group condition, but not in the out-group condition. These findings suggest that the efficacy of soothing depends not only on the strategy itself, but also on the source of support and how it is interpreted by the recipient.

It is important to consider the background of the sample when discussing the findings of our study, since emotional responses are learned through social norms and cultural context. The participants in our study came from Turkish and Iranian societies, both typically categorized as collectivistic cultures (Kagitcibasi, 2017). These cultures emphasize emotional interdependence and close interpersonal bonds, in contrast to individualistic cultures, which prioritise autonomy and self-reliance. As Ford and Gross (2019) noted, the meaning and implications of emotion regulation strategies are not universally influenced by cultural factors, particularly the nature and closeness of interpersonal relationships. Since collectivistic societies normalize and reinforce seeking emotional support from others during times of stress, the soothing strategy may not be interpreted as maladaptive in these societies (Liddell & Williams, 2019). Therefore, in our study, the use of soothing as an interpersonal emotion regulation strategy may be more culturally aligned for individuals from these backgrounds. This cultural congruence may be another explanation for why soothing was more effective in the in-group conditions.

6.4 Practical Implications

The findings of this research provide valuable practical implications for both clinical practice and social support interventions, particularly in multicultural and crisis-affected environments. Most importantly, the results suggest that soothing messages delivered by in-group members are more effective in stress recovery than those delivered by out-group members or through self-regulation alone. This highlights the importance of designing culturally adapted intervention programs, especially in times of acute stress such as natural disasters (e.g., earthquakes or floods), or in politically challenging situations (e.g., war, migration, or displacement). In such circumstances, individuals may lack sufficient internal resources to effectively regulate their emotions. These results support the idea that

intrapersonal emotion regulation can be meaningfully assisted by interpersonal support, especially when it comes from in-group members. Consequently, a more integrative approach that combines both intrapersonal and interpersonal strategies may better foster emotional resilience.

As demonstrated in our findings, such intervention programs should be delivered by members of the target cultural group to maximize their impact. Programs can first be implemented as training modules for local professionals, including psychologists, counselors, mental health workers, and social service providers, who have already worked within the target community. These trained professionals can help to reach broader populations with support strategies that reflect the community's language and cultural values.

Furthermore, these findings support the development of low-cost, practical tools that can easily reach large groups in humanitarian settings. For instance, NGOs, refugee support service, or international crisis response teams can use brief, pre-recorded audio messages in individuals' native languages as a first-step stress relief method. These tools can be distributed via mobile phones, health apps, or community radio channels, so that making them particularly useful in contexts where access to professional psychological services is limited or unavailable.

6.5 Strengths

This experimental study offers several strengths that contribute to the growing literature on interpersonal emotion regulation. Firstly, this study integrates physiological and social psychological perspectives. By combining heart rate reactivity with theories of interpersonal emotion regulation and group memberships, this study offers a more comprehensive understanding of how individuals regulate emotions in social contexts.

Secondly, the use of heart rate as an objective physiological measure strengthens the reliability of the findings, as it provides a real-time indicator of stress reactivity and recovery, beyond limitations of self-reported emotional data.

Lastly, the experimental design was carefully structured. All participants experienced each phase of the study: baseline, stress induction and recovery phases. Moreover, participants were exposed to different forms of support (in-group, out-group, silence) in a counterbalanced order to reduce potential order effects and increase the internal validity of the results.

6.6 Limitations and Future Studies

Despite the valuable contributions of this study, several limitations should be acknowledged. Firstly, the sample size is relatively small. This may limit the generalizability of the findings. A larger sample size would enable more comprehensive statistical analyses and lead to more reliable and externally valid conclusions. Future studies should aim to include larger samples to strengthen the reliability of the results.

Secondly, the cultural backgrounds of the participants were homogeneous since all participants came from two collectivistic societies. This cultural similarity can limit the applicability of the findings to individuals from different cultural contexts, specifically those from individualistic societies. Therefore, future studies are encouraged to include more culturally diverse samples (e.g. Western populations) to enhance representativeness of the findings, as well as to better explore the influence of culture on the impact of interpersonal emotion regulation strategies.

Thirdly, the study did not include subjective emotional assessments of the soothing messages, such as perceived support, emotional relief, or satisfaction with experience. Using only psychological data (i.e. heart rate) can give an incomplete view of emotion regulation process. Future studies are recommended to combine physiological measures with subjective reports to offer more complete knowledge.

Lastly, the study focuses only on the “Soothing” subscale of the Interpersonal Emotion Regulation Questionnaire (IERQ). Although this dimension gives important information about supportive strategies, it represents only one aspect of the interpersonal emotion regulation. Future studies should examine other IERQ components, such as perspective taking, social modeling and enhancing positive affect, to develop a better understanding of how various interpersonal strategies can contribute to emotion regulation in diverse contexts.

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