BABEŞ-BOLYAI UNIVERSITY

FACULTY OF PSYCHOLOGY AND EDUCATIONAL SCIENCES

DOCTORAL SCHOOL "EVIDENCE-BASED PSYCHOLOGICAL ASSESSMENT AND

INTERVENTIONS"

Ph.D. THESIS

ANGER REGULATION AND MENTAL HEALTH

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Cluj-Napoca

2025

ACKNOWLEDGEMENTS

First and firstmost, my immeasurable gratitude and love goes to my grandmother, to whom I owe so much of who I am. Her infinite love, genuine kindness and endless patience guided me through all my darkest hours and will remain with me always.

I would like to express my gratitude to my scientific supervisor, Professor Aurora Szentagotai-Tătar, Ph.D., for her guidance and feedback given throughout my doctoral journey. I am also thankful to Professor Andrei C. Miu, Ph.D., for all his valuable scientific inputs and support that he provided during the research process. Special thanks go to my colleagues and friends in the Doctoral School of "Evidence-based Psychological Assessment and Interventions" and all members of the Department of Clinical Psychology and Psychotherapy at Babeş-Bolyai University, whose encouragement and help I appreciate.

I am very grateful for the teaching opportunities I have received. I am thankful to those who believed in my potential and made these experiences possible, particularly to Assistant Professor Diana Nechita, PhD. These opportunities have been the most meaningful aspects of my academic path. I am also thankful to my students for their highly positive feedback, which had a profound impact on me, especially during moments of self-doubt.

Last but not least, I am grateful to my parents for their unconditional love, acceptance and patience, and to my friends for their care and understanding. Profound gratitude goes to Samuel, who showed me that it is possible for someone to pause and truly listen when it matters most. His unique blend of wholehearted love, practical support and patient presence meant greatly to me.

*Notes.*_____

(1) This is to certify by Pop Gabriela-Viorela that:

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(b)   Parts of the thesis have been already published, in press, or submitted for publication; appropriate citations for these publications were included in the thesis. Other co-authors have been included in the publications, if they contributed to the exposition of the published text, data interpretation etc. (their contribution was clearly explained in the footnotes of the thesis); (c)   The thesis was written according to the academic writing standards (e.g., appropriate scientific acknowledgements and citations have been made in the text by the author of the thesis). All the text of the thesis and its summary was written by Pop Gabriela-Viorela who assumes the all responsibility for the academic writing; also:

- A software was used to check for the academic writing (see at http://www.plagiarismdetector.com/); the thesis has passed the critical test;
- A copy of the research dataset/database was delivered at the Department/Graduate School.
  (electronic) Signature for certifying the Notes: Ph.D. candidate Pop Gabriela-Viorela

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CHAPTER I. INTRODUCTION

1.1. Theoretical Foundations and Review of the Literature

1.1.1. Conceptualization of Anger

1.1.1.1.   Definition

Emotion is typically defined as a short-lived affective response to specific stimuli that support or block personal goals (Izard, 2009). Anger, as a basic emotion, emerges early in life and is universal across cultures (Saini, 2009). It is often associated with physiological arousal and can vary in intensity, from mild irritation to intense rage (Harmon-Jones et al., 2013). While often regarded as negative, anger serves adaptive functions, alerting individuals to perceived injustices or threats and preparing them to take corrective actions (Carver & Harmon-Jones, 2009).

Anger manifests through cognitive, physiological, and behavioral components. Cognitive appraisals, such as other-blame and perceived coping potential, influence how anger is triggered and how individuals react to situations (Harmon-Jones et al., 2013). Physiologically, anger is characterized by increased arousal, muscle tension, and cardiovascular activation (Castilho et al., 2016).

1.1.1.2.   Trait   and   state   anger

State anger refers to a temporary emotional response triggered by specific situations, with varying levels of intensity and physiological arousal (Spielberger, 1988). It can range from mild irritation to extreme rage. Trait anger, however, is a stable personality characteristic that predisposes individuals to experience anger more frequently and intensely. Research suggests a bidirectional relationship between state and trait anger, where chronic tendencies toward anger influence how individuals experience and react to anger-inducing events (Spielberger et al., 1983). Understanding both dimensions provides a comprehensive view of anger's role in emotional and behavioral regulation (Cox & Harrison, 2008).

1.1.1.3.   Anger   theoretical   models

Anger can be understood through several theoretical models. Behavioral theories suggest that anger is conditioned through classical and operant mechanisms. Classical conditioning occurs when arousal becomes paired with aversive stimuli, while operant conditioning emphasizes reinforcement—expressions of anger are maintained when they lead to outcomes like compliance or satisfaction (DiGiuseppe & Tafrate, 2007).

Cognitive theories argue that anger arises from appraisals of events as unjust or harmful. Cognitive Appraisal Theory posits that anger results from events that are perceived as personally relevant and caused by others (Smith & Lazarus, 1993). Additionally, Hostile Attribution Bias, a part of social information processing theory, suggests that individuals with this bias perceive others' ambiguous actions as hostile, further fueling anger (Crick & Dodge, 1994).

Finally, Cognitive-Behavioral Models integrate cognitive and behavioral components, highlighting that anger arises from external events, memories, and internal stimuli (Deffenbacher, 2011). These models emphasize the importance of cognitive appraisals in anger regulation and suggest that interventions should target both cognitive interpretations and behavioral responses to anger.

1.1.2. Relevance of Anger in Psychopathology

1.1.2.1.   Functional   and   dysfunctional   anger

Anger can serve an adaptive function by signaling threats or injustices, motivating corrective actions (Carver & Harmon-Jones, 2009). It enhances focus and readiness, promoting assertiveness and conflict resolution (Mikulincer, 2011). However, when anger becomes excessive or poorly regulated, it may lead to physical and psychological health problems (Potegal & Stemmler, 2010).

Dysfunctional anger, when expressed excessively or inappropriately, can lead to significant social and personal consequences, including domestic violence and aggression (Birkley & Eckhardt, 2015). Moreover, it is associated with a variety of mental health conditions, including depression, anxiety, and personality disorders (Novaco, 2009). Dysfunctional anger impairs emotional regulation, contributing to poorer treatment outcomes and a lower quality of life (Kulkarni et al., 2012).

1.1.2.2. Dysfunctional anger and psychological disorders

Dysfunctional anger is commonly observed in several psychological disorders. For example, in mood disorders, anger often appears as irritability or sudden outbursts, which are linked to more severe depressive symptoms and increased risk of suicidal ideation (Fava, 1999). In anxiety disorders, heightened anger can exacerbate emotional distress and hinder treatment effectiveness (de Bles et al., 2019). Furthermore, anger plays a central role in personality disorders. In borderline personality disorder, dysregulated anger contributes to instability in relationships and self-destructive behaviors (Zanarini et al., 2007). In antisocial personality disorder, chronic irritability and anger fuel impulsivity and aggression (Kolla et al., 2017). Similarly, individuals with narcissistic personality disorder may exhibit intense anger in response to threats to their self-image, a phenomenon often referred to as "narcissistic rage" (Fredrickson, 2001).

1.1.3. Anger and Emotion Regulation

Effective anger regulation is crucial in preventing the negative consequences of dysfunctional anger. Emotion regulation (ER) involves strategies that individuals use to influence their emotional responses to situations (Gross, 2002). Reappraisal, a cognitive strategy where individuals reinterpret an event to change its emotional impact, has been shown to reduce anger and prevent aggressive reactions (Gross & John, 2003). Acceptance, another effective strategy, involves acknowledging emotions without judgment, which can help prevent rumination and impulsive behaviors (Hofmann et al., 2012). Numerous therapeutic approaches focus on anger regulation, particularly cognitive-behavioral therapy (CBT). CBT targets maladaptive thoughts and behaviors that contribute to anger dysregulation, helping individuals identify triggers and develop healthier coping mechanisms (DiGiuseppe et al., 2012). Other interventions, such as mindfulness-based stress reduction (MBSR) and dialectical behavior therapy (DBT), emphasize acceptance and emotional awareness, which can be particularly beneficial for individuals with personality disorders or chronic anger issues (Linehan, 1993).

In sum, while anger is a natural and sometimes adaptive emotion, dysfunctional anger can lead to significant health and social problems. Understanding its regulation through both cognitive and behavioral interventions is crucial for improving treatment outcomes and overall well-being.

1.1.3.1. Emotion regulation models

Emotion regulation (ER) is the process through which individuals influence their emotional experiences, affecting which emotions they have, when they occur, and how they are expressed (Gross, 1998a). ER is crucial in shaping how emotions impact our behavior and well-being, and it involves several key components: the activation of regulation goals, the selection of strategies to achieve these goals, and the outcomes of these efforts (Gross & Thompson, 2007). These goals are often driven by hedonic motives (maximizing pleasure or minimizing pain) or instrumental motives (achieving specific outcomes like negotiation success). Strategies can differ in form and timing, and outcomes are typically assessed based on the intensity, duration, and expression of emotions.

One of the most widely recognized frameworks in ER is Gross's (1998a) Process Model of Emotion Regulation, which classifies regulation strategies based on when they are deployed within the emotional process. These strategies fall into two categories: antecedent-focused strategies, which are

applied before the emotional response fully develops, and response-focused strategies, which are used after the emotional response has already occurred.

Antecedent-focused strategies include: *Situation selection:* Choosing contexts that will minimize emotional distress, such as avoiding a conflict to prevent anger; *Situation modification:* Altering the environment to reduce its emotional impact, like taking a different route to avoid stressful traffic; *Attentional deployment:* Diverting attention to manage emotional responses, such as distracting oneself from a stressful situation.; *Cognitive change:* Reinterpreting an event to alter its emotional significance, like viewing criticism as constructive feedback rather than a personal attack.

Response-focused strategies are applied after the emotional response has been generated and include: *Response modulation:* Modifying the emotional experience itself, for example, by suppressing emotional expression or engaging in calming activities (Gross & Thompson, 2007).

Gross's model highlights the dynamic nature of emotion regulation, where different strategies can interact and influence emotional responses over time. For example, an individual may initially avoid a stressful situation (situation selection) and later reappraise it to reduce lingering negative emotions (cognitive change). This continuous interaction between emotional responses and regulatory efforts underscores the adaptability of ER while also emphasizing its complexity.

To address these complexities, Gross (2015) introduced the Extended Process Model, which conceptualizes ER as a hierarchical, multi-stage process with three main phases: identification, selection, and implementation. The identification phase involves recognizing the emotional state and deciding whether regulation is necessary. The selection phase focuses on choosing the most appropriate strategy based on context, resources, and intensity of the emotion. Lastly, the implementation phase involves executing the strategy and making any necessary adjustments.

This extended model also considers the dynamic aspects of ER, such as maintenance (continuing with the strategy), switching (changing strategies when needed), and stopping (ending regulation when it is no longer necessary). Effective ER requires flexibility in switching and adapting strategies to ensure they remain relevant as emotions evolve (Gross, 2015). However, empirical testing of this extended model is still in its early stages, requiring more research to better understand its real-world application.

Emotion regulation flexibility, as conceptualized by Bonanno and Burton (2013), emphasizes the ability to adapt regulation strategies to fit the emotional context. This framework involves three key components: *Context sensitivity:* The ability to assess whether a situation is controllable or uncontrollable, which influences the choice of regulation strategy. For example, reappraisal may be more effective in uncontrollable situations, while in more controllable circumstances, other strategies may be more appropriate (Troy et al., 2013); *Repertoire:* A diverse array of strategies allows individuals to choose the most suitable approach for a given emotional challenge. A well-developed repertoire leads to better psychological adjustment (Bonanno & Burton, 2013); *Feedback responsiveness:* The ability to monitor and adjust regulation efforts based on ongoing emotional feedback. This dynamic process ensures that regulation remains effective even as emotions change over time.

Bonanno and Burton's model suggests that well-being is not just about using the right strategy but also about employing strategies flexibly and contextually. Deficits in expressive flexibility—difficulty in adjusting regulation efforts—are linked to increased psychological distress, such as higher levels of depression, PTSD, and prolonged grief (Gupta & Bonanno, 2011; Pițur & Miu, 2020). This flexibility is a key protective factor for emotional health, allowing individuals to adapt to varying emotional challenges (Bonanno et al., 2004).

Sheppes's (2012) framework highlights the role of emotion intensity, cognitive resources, and situational demands in the choice of regulation strategies. Sheppes (2012) identifies two primary strategies: *Distraction:* Used early in the emotional process to disengage attention from emotional stimuli. It is effective in high-intensity situations but may limit long-term emotional processing (van Dillen & Koole, 2007); *Reappraisal:* Used at later stages to change how one interprets an emotional event. Reappraisal is associated with long-term emotional regulation but is cognitively demanding, making it less effective for intense emotions (Sheppes et al., 2009). The choice between distraction and reappraisal depends on factors such as emotional intensity, available cognitive resources, and the person's long-term emotional goals.

1.1.3.2. Anger regulation

Anger regulation is a critical area of study within emotion regulation, particularly in its relation to various regulatory strategies. Research has consistently demonstrated that certain strategies, like reappraisal, are effective in reducing anger. Reappraisal involves changing one's perspective on an event to decrease its emotional impact, and studies suggest that it is linked to lower anger levels (Kale & Gedik, 2020; Mauss et al., 2007). However, its effectiveness can be limited in high-intensity emotional situations, as reappraisal requires cognitive resources that may not be available when emotions are overwhelming (Carpenter & Trull, 2013).

Acceptance is another strategy commonly studied in anger regulation. It involves allowing emotions to unfold naturally without attempting to suppress or alter them. Research indicates that acceptance is linked to lower levels of anger (Cludius et al., 2021; Garofalo et al., 2018), especially in high-intensity situations where reappraisal may be less practical (Dixon-Gordon et al., 2015).

Avoidance and rumination, on the other hand, are generally maladaptive strategies in anger regulation. Avoidance may provide short-term relief but often leads to increased anger over time (Crisan & Nechita, 2022), while rumination exacerbates anger and delays emotional recovery (Denson, 2013). Similarly, suppression, while reducing outward expressions of anger, often fails to address the underlying emotional cause, limiting its long-term effectiveness (Alcázar et al., 2011; Schröder-Abé et al., 2007).

Distraction has been shown to reduce anger, particularly in high-intensity situations (Bushman et al., 2005), but like other short-term strategies, it does not resolve the underlying emotional cause, making its long-term impact limited (Fabiansson & Denson, 2012).

1.2. Relevance and Impact of the Research

This research aims to explore the regulation of anger within real-life contexts, investigating how various strategies interact with contextual factors to influence anger and its relationship to psychopathology. The relevance of this research lies in its potential to advance both theoretical understanding and practical applications. By synthesizing the existing literature on anger and emotion regulation, this study seeks to identify consistent associations between anger and regulatory strategies and explore moderators that might explain inconsistencies in past research.

A key goal is to determine which regulation strategies are most effective for managing anger in different contexts. Identifying whether specific strategies like reappraisal or acceptance are consistently beneficial for anger regulation will have significant implications for therapeutic interventions. Furthermore, the study will examine how contextual factors, such as the controllability of a situation, shape emotional responses and regulatory choices. Understanding these dynamics will allow for more tailored interventions based on individual needs and contextual challenges.

Additionally, this research will contribute to understanding the role of expressive flexibility in anger regulation. As a key factor in emotional well-being, expressive flexibility may play a central role in

how individuals manage intense emotions like anger, particularly in relation to mental health outcomes. Exploring this concept could provide valuable insights into how emotional regulation flexibility contributes to psychological resilience and offer practical strategies for improving emotional regulation in clinical settings.

In conclusion, this research has the potential to refine emotion regulation theories, particularly in how they apply to real-life emotional experiences, and inform clinical practices that aim to reduce anger and improve psychological well-being. By examining both the theoretical and practical aspects of anger regulation, the study promises to contribute to the broader field of emotion regulation and psychopathology research.

CHAPTER II. OBJECTIVES AND GENERAL METHODOLOGY

We aimed to address several of the research gaps in the field of anger regulation by conducting four original studies, each with a specific research objective and methodology.

The first question that arises based on the available literature is whether the differential use of emotion regulation strategies is consistently associated with anger and in which direction. In order to answer this question, our first objective was:

1. Identify and characterize the consistent associations between anger and multiple emotion regulation strategies as well as to investigate potential differences in studies that could explain heterogeneity in previous findings on the topic.

Targeting this objective, we conducted a quantitative review of the associations between anger and six commonly studied emotion regulation strategies (i.e., acceptance, avoidance, distraction, reappraisal, rumination, and suppression) (Study 1; see Figure 1).

Considering the current literature on anger regulation, an important question arises regarding the spontaneous use of these strategies in individuals' natural environment, and the importance of contextual features and regulatory motives in emotion regulation. Therefore, subsequent to meta-analysis, our second research objective was:

2. Examine the relationships between anger and the habitual use of emotion regulation strategies in real-world settings, while also exploring the role of contextual influences on anger regulation.

In line with this object, we conducted an ecological momentary assessment study to investigate the concurrent and lagged relationships between anger and emotion regulation strategies (Study 2; see Figure 1). Additionally, we explored how perceived controllability and emotion regulation motives moderate these relationships.

Consequently, the efficacy of two promising emotion regulation strategies (i.e., reappraisal and acceptance) on problematic anger will be explored among individuals with high levels of trait anger. Given that the online therapeutic interventions have become increasingly popular, being part of the nowadays mental health care landscape, our objective was:

3. Examine the effectiveness of two distinct online emotion regulation-based interventions—one based on reappraisal and the other on acceptance—in reducing anger levels among individuals with high trait anger.

This objective was investigated in Study 3, employing an experimental design to assess the effectiveness of reappraisal- and acceptance-based interventions in reducing anger when delivered in an online format.

Lastly, in an effort to deepen the understanding of anger dysregulation as an underlying mechanism of psychopathology, we focused on recent research highlighting the role of expressive

flexibility—a form of emotion regulation flexibility—in psychopathology and its potential involvement in the relationship between childhood maltreatment, a key risk factor, and psychopathology. Moreover, given the presence of anger across multiple psychiatric disorders, we also emphasize the importance of testing an assessment paradigm (i.e., the Ultimatum Game) designed to induce anger in a real-life situation, while examining anger-related expressive flexibility. Building on this research foundation, we established the following objectives:

4. Examine the effectiveness of the anger-infused version of the Ultimatum Game in inducing anger and aggressive behavior.

5. Investigate the mediating role of anger-related expressive flexibility in the relationship between childhood maltreatment and psychopathology.

In order to achieve these objectives we conducted an experimental study (Study 4; see Figure 1). In this study, we integrated the expressive flexibility paradigm (developed by Bonanno and collaborators, 2004) into the Anger-infused Ultimatum Game (created by Gilam et al., 2019) to examine the effectiveness of anger induction in a simulated social interaction context, while investigating the mediating role of anger-related expressive flexibility in the relationship between childhood maltreatment and psychopathology.

The studies conducted as part of this thesis are systematically outlined in Figure 1, providing a clear overview of the research structure.
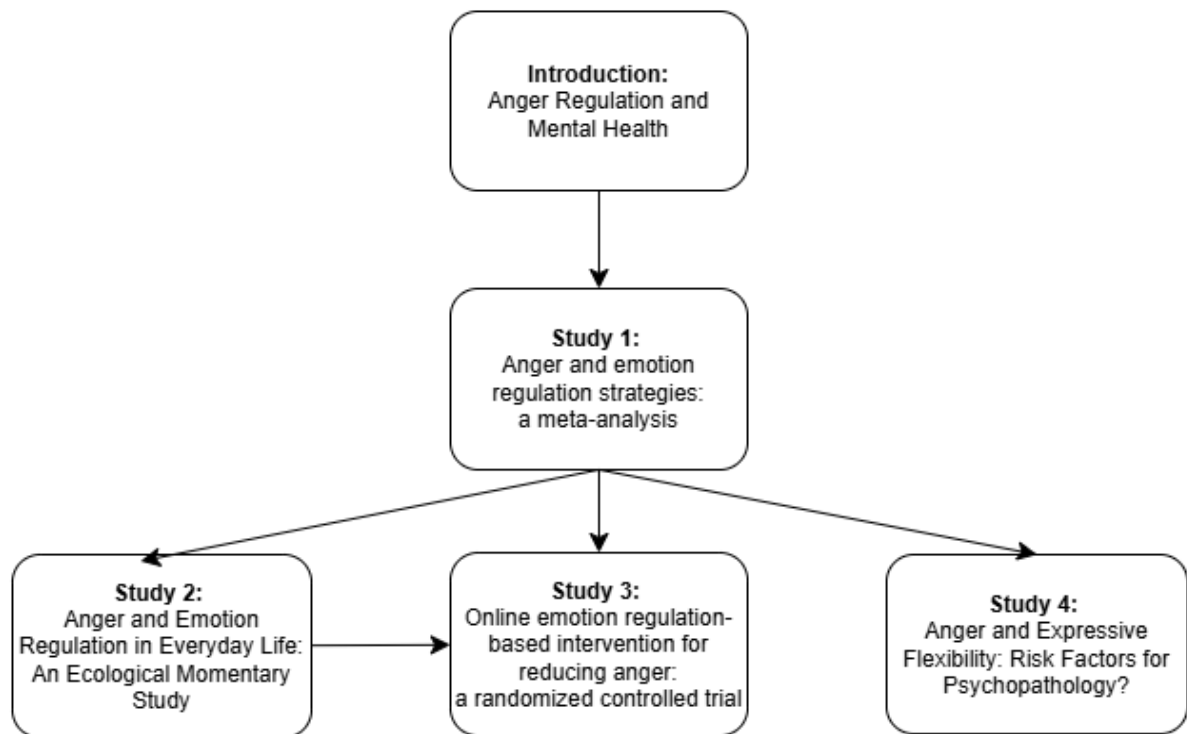

Figure 1 Structure of this thesis

CHAPTER III. ORIGINAL RESEARCH

3.1. Study 1. Anger and Emotion Regulation Strategies: A Meta-Analysis[1]

3.1.1. Introduction

Anger is a common emotional experience in everyday life (Kashdan et al., 2016). When anger is too frequent or too intense, it is associated with a range of antisocial behaviors (Birkley & Eckhardt, 2015). Furthermore, it has been documented in multiple mental disorders, being associated with greater symptom severity, greater comorbidity and lower quality of life (Barrett et al., 2013).

According to an influential perspective, maladaptive emotion regulation is a central mechanism underlying problematic anger and its negative implications (Roberton et al., 2012).

3.1.1.1. Theoretical perspectives on anger and emotion regulation

One of the theoretical frameworks that have focused on the role of emotion regulation in anger and aggression has been articulated by Roberton and coworkers (2012). According to this view, there is a continuum of maladaptive emotion regulation "styles" underlying aggression, ranging from emotion under-regulation to emotion over-regulation. Emotion under-regulation refers to failures to regulate negative affect (e.g., anger) in a sufficient manner so as to maintain goal-directed behavior. Over-regulation relies on attempts to block negative affect altogether, either by avoiding unpleasant emotional experiences or the situations that may trigger it, or by suppressing its expression. These maladaptive emotion regulation styles involve a variety of strategies, which are not inherently maladaptive, but become so when used improperly (e.g., irrespective of situational demands; Roberton et al., 2012). Rumination, an emotion regulation strategy that involves repetitive thinking about negative emotions (Nolen-Hoeksema et al., 1993), is viewed here as a cognitive form of anger avoidance. When used to escape anger, it is hypothesized to be maintained through negative reinforcement (Gardner & Moore, 2008). Rumination can further contribute to the amplification of anger. In contrast, controlled processes can buffer anger reactions, through the reappraisal of the situation as non-hostile and through the interruption of rumination and distraction from hostile thoughts (Allen et al., 2018).

Overall, these theoretical models assume that maladaptive emotion regulation is central to problematic anger. They also attempt to illustrate the strategies involved in both the upregulation (e.g., rumination, suppression) and the downregulation (e.g., reappraisal, distraction) of anger.

3.1.1.2. Multiple emotion regulation strategies in anger

The focus on multiple emotion regulation strategies in current research dates back to pioneering clinical interventions and basic studies on anger. Reappraisal is an emotion regulation strategy that involves reinterpreting the situation in order to modulate its emotional impact (Gross, 1998a), and is a central skill targeted by cognitive-behavioral interventions (Del Vecchio & O'Leary, 2004), which have consistently been shown to be efficient (Del Vecchio & O'Leary, 2004; DiGiuseppe & Tafrate, 2003). In a similar manner, experimental studies (Szasz et al., 2011) have investigated the potential effect of acceptance (i.e., leaving emotion unfold naturally) in reducing anger, in light of the central role attributed to this emotion regulation strategy in acceptance- and mindfulness-based interventions (Gratz & Tull, 2010; Hayes et al., 2006).

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[1] This study was published:
Pop, G. V., Nechita, D. M., Miu, A. C., & Szentágotai-Tătar, A. (2025). Anger and emotion regulation strategies: a meta-analysis. *Scientific Reports, 15*(1), 6931.

Another emotion regulation strategy linked to anger in early work is expressive suppression. This strategy involves inhibiting the expression of emotion. Coined as "anger-in", anger suppression has also been assessed as an individual difference (Harburg et al., 1979).

In studies examining anger, rumination was associated with both increased aggressive behavior and slower physiological recovery (i.e., prolonged cardiovascular reactivity) following anger-inducing events (Bushman et al., 2005). Several studies compared between reappraisal, acceptance and suppression, and found that the former strategy was more efficient in reducing anger compared to the latter two strategies (Szasz et al., 2011)

3.1.1.3. The present meta-analysis

Roberton et al. (2012, p. 79) have argued that the concept of emotion regulation is clearly a cornerstone in current research on problematic anger, but that "unless a cohesive stream of research is established, it may become difficult to draw conclusive findings from different studies." The present meta-analysis set out to offer an integrative perspective on current evidence, by identifying consistent associations between anger and multiple emotion regulation strategies. We focused on six emotion regulation strategies and, in light of current perspectives on the relative efficiency of emotion regulation strategies (Webb et al., 2012), we expected that some (e.g., acceptance, distraction, reappraisal) showed a negative and others (e.g., avoidance, rumination, suppression) showed a positive association with anger.

To reduce heterogeneity related to methodological differences between studies in adults vs. other age categories (e.g., children), we restricted the present meta-analysis to adults. Also, we focused on subjective measures of anger and on the habitual and spontaneous use of emotion regulation strategies. This focus was reflected in self-report questionnaires that assessed both the global use of these strategies and their spontaneous use in specific contexts, such as through ecological momentary assessment. Since these measures did not overlap with the instructed use of emotion regulation (McRae et al., 2012), we decided to exclude experimental studies in which emotion regulation strategies were manipulated.

Another aim of the present meta-analysis was to uncover differences between studies that could explain heterogeneity in previous results on anger and emotion regulation. Considering that trait anger is a relatively stable individual difference (Spielberger et al., 1988), whereas state anger varies across contexts (which may or may not be specified), we expected the former to be more consistently associated with emotion regulation.

Clinical status was also examined as potential moderator considering that problematic anger has been associated with multiple mental disorders (Cassiello-Robbins & Barlow, 2016). Here, we also considered the distinction between studies that focused on clinical samples (i.e., patients diagnosed with a mental disorder) and those that selected individuals for high levels of anger, involving clinically relevant behavioral dysfunctions (Ahmed et al., 2012). We expected higher effect sizes of the associations between anger and emotion regulation in studies on clinical samples and samples with clinically relevant levels of anger, compared to general samples.

Another potential moderator that we considered was criminal status, in light of studies showing that both problematic anger (Fernandez et al., 2014), and maladaptive emotion regulation (Gardner et al., 2014) are increased in offenders compared to non-offenders.

Cultural differences were also examined as a potential moderator. Individualist cultures emphasize the role of emotions in individual wellbeing, whereas collectivist cultures prioritize social convention (Suh et al., 1998), and these differences influence the use of emotion regulation and its consequences.

Sample differences were also investigated as potential moderators, particularly sex distribution and age category. Previous studies on sex differences in the use of emotion regulation strategies such as suppression (Kerr & Schneider, 2008) and rumination (Peled & Moretti, 2010), are inconsistent, but this issue has remained open. Previous work has also investigated potential differences in anger regulation between younger and older adults, also with apparently inconsistent results on strategies such as suppression (John & Gross, 2004) and reappraisal (Brockman et al., 2017).

Finally, we considered the possibility that methodological differences explained heterogeneity in previous studies. Study design (i.e., cross-sectional vs. longitudinal) and study quality were examined, with the expectation that longitudinal and higher-quality studies showed more consistent associations between anger and emotion regulation.

3.1.2. Method

The current meta-analysis followed the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) statement (Moher et al., 2010) recommendations. The protocol was pre-registered in PROSPERO (registration number CRD42020214171).

3.1.2.1. Search strategy

The search was conducted in five bibliographical archives (PubMed; PsycINFO; Scopus; Web of Science; Cochrane Central Register of Controlled Trials), from inception until April 3, 2022. We searched for the following keywords in title and abstract: "anger", "emotion regulation", "reappraisal", "suppression", "distraction", "rumination", "acceptance", "avoidance" (see Supplementary Material 1 for the complete search string). In addition, we searched for relevant articles in the reference section of previous reviews. The search was restricted to articles in English.

3.1.2.2. Eligibility criteria

Studies were eligible if they met the following criteria: (1) they were original quantitative studies, published in peer-reviewed journals; (2) they were conducted in humans; (3) they reported the relation between anger and one or more of the emotion regulation strategies (i.e., acceptance, reappraisal, avoidance, distraction, rumination, suppression); and (4) they provided sufficient statistical data for effect size estimation. We included both correlational studies and studies that compared groups with different levels of anger on emotion regulation. Studies were also excluded if they: (1) were conference abstracts, letters, dissertations or book chapters; (2) were reviews or meta-analyses not reporting original data; (3) were case studies or qualitative studies; and (4) used the same sample as another eligible study. Adults were the target population of the present meta-analysis and therefore, we excluded studies on samples with a mean age lower than 18 years.

3.1.2.3. Clarification of relevant constructs

Anger. We focused on anger, which has been distinguished from hostility, which refers to a pervasive aggressive attitude (Del Vecchio & O'Leary, 2004). In line with the phenomenological perspective (Spielberger et al., 1983), only measures of the subjective experience of anger were considered, and not measures of other aspects, such as physiological or behavioral responses related to anger. We included studies that focused on trait anger, state anger unrelated to a specific event, and state anger associated with a specific context (such as a real-world event or an anger-inducing manipulation, for which we considered only post-induction assessments).

Emotion regulation strategies. The following emotion regulation strategies were included in the analysis: (1) avoidance (i.e., reluctance to and refraining oneself from experiencing an emotional event); (2) acceptance (i.e., allowing for emotional experiences to unfold naturally); (3) distraction (i.e., moving attention away from an emotional event); (4) cognitive reappraisal (i.e., changing one's perspective of an

emotional event); (5) rumination (i.e., repetitive thinking about an emotional event or experience); and (6) suppression (i.e., inhibiting the behavioral expression of emotion).

3.1.2.4. Study selection

All retrieved articles were uploaded in EndNote, and duplicates were eliminated. The titles and abstracts were independently checked by two researchers. The full texts of the selected studies were also independently assessed by two researchers, based on inclusion and exclusion criteria.

3.1.2.5. Data extraction and coding

For each study, the following data were extracted: (1) identification information (i.e., author, year); (2) sample information (i.e., sample size, mean age of the participants, percentage of female participants per study, clinical status, criminal status); (3) emotion regulation strategy; (4) type of anger (i.e., trait, state); (5) instrument used to assess anger; (6) instrument used to assess emotion regulation; (7) effect size; and (8) research design (i.e., cross-sectional, longitudinal). When the relevant data were not reported, authors were contacted for additional details.

The risk of bias in individual studies was assessed by two independent researchers, using tools provided by the National Heart, Lung, and Blood Institute. The Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (NHLBI, 2018) was used for cross-sectional studies, and the Quality Assessment of Case-Control Studies (NHLBI, 2018) for studies in which individuals selected for high and low anger levels were compared. The methodological quality of studies was evaluated in line with the following characteristics: (1) clear research objective; (2) clear specification of the sample (eligibility criteria, justification for the sample size); (3) reliable and valid instruments; and (4) controlling of potential confounding variables. For each criterion, studies were categorized as "yes", "no", "cannot determine" (CD), "not applicable" (NA), or "not reported" (NR). In line with previous work (Mendez-Bustos et al., 2019), the quality of studies was considered good if more than 11 items were rated "yes", fair if 6–9 items were rated "yes", and poor if fewer than 6 items were rated "yes".

3.1.2.6. Meta-analytic plan

Considering our focus on the association between anger and emotion regulation strategies, the Pearson correlation coefficient (r) was used as the index of effect size. In studies comparing individuals selected for anger, we used the group mean, standard deviation and sample size for independent groups to compute Pearson's r (Hedges, 1992). The analysis was conducted in Comprehensive Meta-analysis version 4.0. The magnitude of the effect sizes was interpreted in accordance with Gignac and Szodorai (2016): small when $r = .10$, medium when $r = .20$, large when $r = .30$.

A random-effect model was employed in all analyses (Borenstein et al., 2010). In order to examine whether there is significant true variance (i.e., beyond random error) in effect sizes between studies, we assessed heterogeneity with the Q statistic test (Cooper et al., 2009), and estimated the proportion of true variance using the I^2. An I^2 index value of 0% indicates no observed heterogeneity, a value of 25% indicates low heterogeneity, of 50%, moderate heterogeneity, and of 75% or above, high heterogeneity (Higgins et al., 2003).

We examined the following categorical moderators: (1) type of anger: trait anger vs. state anger related to a specific event vs. state anger not related to a specific event; (2) clinical status: participants with a clinical diagnosis (i.e., any mental disorder diagnosed by a clinician using structured clinical interview) vs. participants with clinically-relevant anger problems (i.e., who scored in the upper quartile on the Trait Anger Scale, TAS > 22, and reported having severe anger problems) but no clinical disorder diagnosis, vs. nonclinical participants; (3) criminal status: offenders (i.e., participants who were imprisoned or perpetrated intimate partner violence, based on self- or other-reports) vs. non-offenders; (4)

type of culture: collectivist vs. individualist, classified as such using the Hofstede's Country Comparison Tool (https://www.hofstede-insights.com/country-comparison-tool, accessed November 3, 2023); (5) study design: cross-sectional vs. longitudinal; and (6) study quality: good vs. fair vs. poor. In line with common practice in meta-analysis, a subgroup analysis was run only if there were at least three studies in at least two subgroups. For studies reporting effect sizes for multiple moderator categories on the same sample, in order to ensure that the assumption of independence was not violated in subgroup analyses, we selected only one effect size, specifically the one that added to the less represented subgroup.

Participants' demographic characteristics (i.e., percentage of women; mean age) and risk of bias across studies were considered potential continuous moderators. A restricted maximum likelihood model for the meta-regression analyses was performed.

Publication bias was examined in three ways: (1) visual inspection of the funnel plot; (b) the trim-and-fill method, which imputes missing studies that would render the funnel plot symmetrical, and estimates an adjusted effect size (Borenstein et al., 2009; Duval & Tweedie, 2000); and (c) the Egger test, which assesses whether the funnel plot is significantly asymmetrical (Egger et al., 1997).

3.1.3. Results

3.1.3.1. Study selection and inclusion

The search returned 9262 articles. After removing 4256 duplicates, a total of 5006 articles were screened based on title and abstract, and 4808 articles were excluded for not meeting the inclusion criteria. The remaining 198 articles were evaluated full-text, and 114 were excluded based on the inclusion and exclusion criteria. A total of 81 studies met the eligibility criteria and provided enough data for effect size estimation.

3.1.3.2. Characteristics of included studies

The studies included in the analysis provided 115 effect sizes on the association between anger and one of the emotion regulation strategies: suppression ($k = 41$), rumination ($k = 37$), reappraisal ($k = 12$), acceptance ($k = 12$), avoidance ($k = 12$), and distraction ($k = 1$). Most of these studies (93.82%) were cross-sectional, and the rest ($k = 5$) were longitudinal.

3.1.3.3. Global effects

Anger was positively associated with avoidance, rumination, and suppression, and negatively associated with acceptance, and reappraisal. Heterogeneity was significant and high in all analyses.

3.1.3.4. Study quality

The methodological quality of most studies ($k = 56$) was assessed as "poor" (see Supplementary Material 1, Tables 1-2). Twenty-three studies were rated "fair", and only 2 were rated "good". Common limitations were use of cross-sectional designs, lack of sample size justification, and failure to control relevant confounding variables.

3.1.3.5. Subgroup analyses

Type of anger (i.e., trait anger vs. state anger related to a specific event vs. state anger not related to a specific event) was a significant moderator of the association between anger and suppression, with a medium positive effect size for trait anger, a low positive effect size for state anger related to a specific event, and a non-significant effect size for state anger not related to a specific event.

Clinical status (i.e., clinical diagnosis vs. clinical anger vs. non-clinical) was a significant moderator of the association between anger and suppression, with a high positive effect size in samples with clinical anger, a medium positive effect size in samples with a clinical diagnosis, and a small-to-medium positive effect size in non-clinical samples. The positive effect size of the association between

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anger and avoidance was also larger in clinical compared to non-clinical samples (clinical anger could not be included in this analysis due to $k < 3$).

Criminal status (i.e., offenders vs. non-offenders) was a significant moderator in the relation between anger and acceptance, with a larger negative effect size in offenders than in non-offenders.

Type of culture (i.e., individualist vs. collectivist) was a significant moderator of the relation between anger and rumination, with a larger positive effect size in samples from collectivist cultures, compared to samples from individualist cultures. It was also a significant moderator of the relation between anger and suppression, with samples from individualist cultures showing higher positive effect sizes compared to samples from collectivist cultures.

Type of design (i.e., cross-sectional vs. longitudinal) could not be tested as moderator given that there were fewer than necessary (i.e., $k < 3$) studies per subgroup.

Study quality (i.e., fair vs. poor; good-quality studies were not included because $k < 3$) was a significant moderator in the associations between anger and acceptance, avoidance, rumination, and suppression. In all subgroup analyses, fair-quality studies showed a higher effect size compared to poor-quality studies.

3.1.3.6. Meta-regressions

The percent of women was a significant positive predictor of the effect size of the association between anger and acceptance, while mean age was not a significant moderator of the relations between anger and any of the emotion regulation strategies.

3.1.3.7. Publication bias

The funnel plots suggested the distribution of the effect sizes was symmetrical for the relations between anger and reappraisal, rumination, and suppression. For the relations of anger with both acceptance and avoidance, the funnel plots showed some asymmetry to the left.

The trim-and-fill procedure imputed two studies in the analysis of the relation between anger and acceptance, which slightly decreased the effect size ($r = -.27$). One study was imputed in analysis on anger and reappraisal, and the effect size decreased slightly ($r = -.11$). It also imputed three studies in the analysis of the relation between anger and suppression, which decreased the effect size ($r = .19$). No study was imputed in the analyses on anger and avoidance, and rumination.

Egger's test also indicated that the distribution of effect sizes was symmetrical in all analyses (all ps $\geq .069$), except that on the relation between anger and avoidance ($p = .007$).

3.1.4. Discussion

The present results supported consistent associations between anger and multiple emotion regulation strategies, ranging from small to large effect sizes. In addition, the present results identified multiple study-level differences that explained heterogeneity in previous results.

Anger was positively associated with avoidance, rumination, and suppression. These results are in line with theories which have argued that problematic anger involves exaggerated efforts to avoid or block this emotion (Gardner & Moore, 2008; Roberton et al., 2012). They also accord with experimental evidence showing that rumination and suppression increase and prolong anger (Szasz et al., 2011). Anger was also negatively associated with the use of acceptance and reappraisal. Theories of psychopathology view the former strategy as fundamental for adaptive emotion regulation (Gratz & Tull, 2010), whereas the latter strategy plays a central role in cognitive-behavioral interventions (DiGiuseppe & Tafrate, 2003).

Are the present results trivial or do they offer a much-needed perspective on a large and heterogeneous literature? Despite apparent theoretical agreement, it is noteworthy that previous evidence has not always supported the expected pattern of associations between anger and emotion regulation

strategies. For instance, while most studies reported positive associations between anger and both avoidance and suppression, and negative associations between anger and both acceptance and reappraisal, some of the previous studies reported correlations in the opposite direction. Furthermore, the effect sizes of these correlations varied widely, ranging from small to large. Therefore, we believe that the present meta-analysis was necessary and contributes to the field by examining whether the previously reported associations between anger and emotion regulation strategies are consistent across studies.

Another question is whether the pattern of emotion regulation strategies associated with anger in the present meta-analysis converges with the results of previous meta-analytic efforts across emotions. Evidence suggests that emotion regulation may partially differ between emotions. For instance, avoidance was used in anger more than in sadness, and the reverse was true for reappraisal (Rivers et al., 2007). A meta-analysis also supported the view that the efficiency of emotion regulation differed between emotions, being lowest in anger and highest in sadness, among the negative emotions that were analyzed (Webb et al., 2012). The present results extend this perspective by identifying the emotion regulation strategies that are positively (i.e., avoidance, rumination, suppression) and negatively (i.e., acceptance, reappraisal) associated with anger. This pattern seems partially different from the one found across emotions (Webb et al., 2012) in that suppression is positively associated with anger (and negatively across emotions), and the effect sizes are larger for anger than across emotions.

Another contribution of the present meta-analysis relates to the identification of study characteristics that were found to consistently influence the relations between anger and emotion regulation. For instance, the association between anger and suppression was stronger in studies assessing trait anger compared to those assessing state anger related to a specific event, while studies assessing state anger without a reference event found no significant association. This supports the view that by focusing on context-independent dimensions of anger, dispositional measures capture more of the association with suppression compared to state anger.

As expected, we found that the positive relation between anger and both suppression and avoidance was larger in clinical compared to non-clinical samples. This is in line with the dimensional approach to psychopathology, which argues that clinical disorders are at the upper extreme of a continuum of individual differences or symptoms in the population (Brown & Barlow, 2005). The association of anger with suppression was large in samples with clinically suggestive levels of anger (i.e., characterized by high levels of negative consequences), and medium in clinical samples selected for any diagnosis of a mental disorder. The likely explanation is that anger problems are present in multiple mental disorders, being more prominent in some disorders (e.g., oppositional defiant disorder, borderline personality disorder, antisocial personality disorder and bipolar disorders) than in others (Hawes et al., 2016). Only one out of five studies in clinical anger samples reported mental disorder diagnoses. This study (Donahue et al., 2017) suggested a large overlap between anger problems and mental disorders, with 96% of the sample having been diagnosed with psychopathology. Future studies should report clinical status in order to allow for a more extensive examination of this issue.

The comparison between offenders and non-offenders revealed a stronger negative association between anger and acceptance in offenders. This is in line with the view that anger problems are associated with antisocial behaviors, and that low acceptance of anger may be fundamental in the maladaptive regulation of anger that underlies these behaviors (Gardner & Moore, 2008).

The positive association between anger and suppression was larger in samples from individualist compared to collectivist countries. As previously suggested (Le & Impett, 2013), this may reflect that suppression, which typically involves holding back emotions for the sake of social relationships, is less

congruent with the self-focused values promoted in individualist cultures. The present meta-analysis cannot discern whether culture promotes anger through suppression, or suppression through anger. The same applies to the positive association between anger and rumination, which was larger in samples from collectivist compared to individualist cultures.

The proportion of women in the sample was positively associated with the effect size of the relation between anger and acceptance. We see two potential explanations: compared to men, women may use acceptance to regulate anger more often, or they may use it more efficiently. Previous studies have generally not supported sex differences in acceptance across emotions (Gratz & Roemer, 2004; Nolen-Hoeksema & Aldao, 2011), whereas the studies on anger acceptance included in the present meta-analysis did not examine sex differences. Therefore, we cannot provide a clear explanation, and it remains possible that this finding is driven by other sample characteristics that we did not control for.

Finally, for all emotion regulation strategies but suppression, the effect sizes were larger in the subgroup of studies rated as qualitatively better. This suggests that the present effects may have been underestimated due to the inclusion of studies that did not meet methodological rigors.

The present meta-analysis has several limitations, which reflect research gaps in the studies that were included. First, most of previous work is cross-sectional and correlational, which precludes any conclusion on the direction of the effects (i.e., anger drives emotion regulation strategies, vice-versa, or both ways). We urge researchers to increasingly use longitudinal designs in future work and examine bidirectional pathways between anger and emotion regulation. This would also contribute to increasing study quality, which is considerably limited in previous studies.

Second, there is only one study on anger and distraction (Carr, 2020), and this study focused on behavioral rather than cognitive forms of distraction. Considering experimental evidence showing that when emotional intensity is high, people prefer distraction over reappraisal, and distraction is more efficient than reappraisal (Sheppes et al., 2014), future studies should investigate this strategy in anger. Furthermore, multiple subgroup analyses could not be run in the present analyses, which highlights specific aspects on which data is still limited.

Third, given the central role of emotion regulation in anger problems, studies should increasingly investigate this issue in clinical populations. Previous data is limited and did not allow us to compare the relations between anger and emotion regulation strategies between mental disorders. Anger problems are transdiagnostic, but they may be more prominent in certain disorders compared to others. Empirical investigations of this issue could crucially support efforts to define clinical anger.

Fourth, there was suggestive evidence that publication bias may have confounded the present analyses. While the results of statistical analyses of publication bias were not consistent, all analyses except those on reappraisal and rumination showed some degree of publication bias.

Finally, we underscore the importance of focusing on the mediator role of emotion regulation in the relation between anger and aggressive behavior. There has been long-standing theoretical and clinical interest in this hypothesis, but data remains limited.

The present results support the view that anger is consistently associated with the differential use of multiple emotion regulation strategies. This offers an encouraging perspective on a long-standing hypothesis that has been at the heart of clinical theories and interventions in anger and suggests ways in which basic and clinical work in this area could be improved and extended.

3.2. Study 2. Anger and Emotion Regulation in Everyday Life: An Ecological Momentary Study
3.2.1. Introduction

Problematic anger has been documented in multiple mental disorders (Novaco, 2009) and is linked to greater symptom severity, higher comorbidity, worse treatment outcomes and lower quality of life (Cassiello-Robbins et al., 2015).

Emotion regulation (i.e., the processes involved in modulating the occurrence, intensity and duration of emotions; Gross & Thompson, 2007) is considered a central mechanism in the relation between anger and psychopathology (Mancke et al., 2017). One influential theoretical perspective (Roberton et al., 2012) suggests that difficulties in regulating anger range from failing to control outward angry reactions (i.e., under-regulation) to blocking the emotional experience (i.e., over-regulation). Under-regulation involves failing to reinterpret an emotional trigger (i.e, reappraisal) or to observe, acknowledge and contain the emotional experience (i.e., acceptance). On the other hand, over-regulation of anger typically occurs when individuals actively attempt to inhibit the expression of emotions (i.e., expressive suppression) or to escape the experience of anger (i.e., avoidance). Rumination, which involves a repetitive thought process dwelling on negative emotions (Watkins, 2008), can also be considered an over-regulation strategy because it involves the cognitive avoidance of experiencing anger (Gardner & Moore, 2008). Distraction, defined as shifting attention from an emotional event, may reflect under-regulation when used with acceptance but fails to reduce emotional intensity, or over-regulation when used with avoidance to escape the emotion (Wolgast & Lundh, 2017).

Research on anger regulation has found that anger, both trait (i.e., a relatively stable tendency; Spielberger, 1988) and state (i.e., a transitory response to an immediate stimulus; Spielberger, 1988), is associated with reduced habitual acceptance and reappraisal, and increased habitual rumination, avoidance and suppression (e.g., Cludius et al., 2021; Kale & Gedik, 2020). However, most of the literature relies on single retrospective assessments of habitual ER strategies use, which are prone to recall and generalization biases (e.g., Blome & Augustin, 2016), and often influenced by mood states (e.g., Sato & Kawahara, 2011). Moreover, these assessments fail to account for within-individual variability, limiting the ability to predict ER use in specific moments. Ecological Momentary Assessment (EMA) addresses these limitations (Myin-Germeys et al., 2018). This approach captions both within-, and between-individual variance, providing a more ecological and accurate understanding of the psychological phenomenon being measured (Moskowitz & Young, 2006). Limited research has examined contemporaneous and lagged relations between anger and ER strategies, with existing studies linking state-anger to suppression (Burns et al., 2015) and rumination in daily life (Borders & Lu, 2017; Smith et al., 2023). Moreover, Borders and Lu (2017) showed that anger and rumination predicted each other concurrently, but only previous rumination predicted current anger. However, the existing literature is limited, and studies have only examined a few strategies, (i.e., suppression and rumination), resulting in limited knowledge about the ecological relation between anger and other commonly used strategies (e.g., reappraisal, acceptance, distraction).

3.2.1.1. Trait-anger, state-anger and ER strategies

The current study aims to extend the limited EMA research on anger regulation by examining the relation between daily anger and the spontaneous use of several ER strategies (i.e., reappraisal, distraction, avoidance, acceptance, rumination, suppression). In line with previous correlational and EMA studies (e.g., Borders & Lu, 2017; Brassard et al., 2014; Burns et al., 2015), we hypothesized that trait- and state-anger would be positively associated with rumination, suppression and avoidance, and

negatively associated with reappraisal and acceptance. Concerning distraction, we had an exploratory aim, considering that data regarding this strategy are scarce.

We explored the relation between state-anger and specific ER strategies at both within-individual (i.e., how a person's use of a strategy varies from one situation to another) and between-individual (i.e., how the use of a strategy varies between different people) level.

3.2.1.2. State-anger, ER strategies, perceived control, and motives

Literature suggests that the relations between affect and specific ER strategies may be influenced by personal characteristics and contextual factors (Aldao et al., 2015). One such factor is the perceived controllability of a situation (Troy et al., 2013). When a situation is perceived as uncontrollable, ER strategies focused on the response, such as reappraisal or avoidance may be preferred, and associated with reduced negative affect and greater well-being (Socastro et al., 2022). Findings also suggest that in low controllable situations, rumination use increases, which is positively associated with anger (Kircanski et al., 2015). We therefore hypothesized that in less controllable contexts individuals will experience less anger when engaging in reappraisal and avoidance, but more anger when engaging in rumination.

Recent research has demonstrated that ER motives (i.e., the reasons why people regulate their emotions) also play a central role in strategy use (Eldesouky & English, 2019). According to a taxonomy proposed by Tamir (2016), ER motives are divided into two main categories: hedonic (i.e., regulating emotions to maximize pleasure and minimize pain) and instrumental (i.e., regulating emotions to attain desired outcomes such as performance or social connections). Since anger is an unpleasant emotional experience, individuals with higher hedonic motives may be more motivated to engage in reappraisal, which is generally linked to reduced anger (Mauss et al., 2007). However, if an individual believes that anger would align with their instrumental motives (e.g., winning a competition or performing at a confrontational task), they might use strategies that maintain or enhance anger, such as rumination (Tamir, 2016). The limited literature precluded a hypothesis; we therefore tested how hedonic and instrumental motives moderate the relation between anger and specific ER strategies.

3.2.2. Method

3.2.2.1. Participants

Of the total participants recruited online, 117 completed baseline measures and 103 proceeded to the EMA phase. Following participant attrition, the final sample consisted of 47 participants (83% women), aged between 18 to 70 (mean age = 32, SD = 11.94). All participants were Caucasian and resided in urban areas, with 34.04% (n = 16) holding a bachelor or master's degree. The study was granted with ethical approval from The Ethical Committee of Babeș-Bolyai University, and all procedures were conducted in compliance with the Declaration of Helsinki recommendations.

3.2.2.2. Instruments

3.2.2.2.1. Demographics.

Participants initially completed demographic information.

3.2.2.2.2. Trait-Anger.

Trait-anger was assessed using the Trait-Anger subscale of the State–Trait Anger Expression Inventory-2, (STAXI-2, T-Anger; Spielberger et al., 1988). This is a 10-item instrument, rated on a 4-point Likert (1 = not at all to 4 = a lot). It assesses the individual's disposition toward experiencing anger. This instrument showed good reliability in the present sample (Cronbach's alpha = 0.89).

3.2.2.2.3. EMA measures.

During each EMA signal, participants received questions related to state-anger, ER strategies, adapted from the Emotion Regulation Questionnaire (Gross & John, 2003), ER motives, adapted from the

taxonomy of ER motives (Tamir, 2016), and perceived control over the angering situation. If participants indicated experiencing anger since the last beep, they rated its intensity on a 6-point Likert scale ranging from 1 (a little) to 7 (very much). ER strategies (what did you try to do to control your anger?), included: (i) distraction (I redirected my attention to something else), (ii) acceptance (I accepted the way I felt without criticizing other or myself); (iii) avoidance (I avoided experiencing anger); (iv) cognitive reappraisal (I changed the way I initially thought about what happened), (v) rumination (I kept thinking about what happened), (vi) suppression (I hid my anger from others), all rated on a 7-point Likert scale, ranging from 0 (not at all) to 7 (very much). ER motives (to what extent did you try to control your anger having the following motives?) were: hedonic (2 items: to feel better and to intensify anger instead of other emotions) and instrumental, including performance (2 items: to solve the situation at hand and to successfully complete a task), social (2 items: to maintain good relationships with others and to influence the behavior of others), epistemic (2 items: to react consistently and to have a positive opinion of myself) and eudaimonic (2 items: to explore ways of reacting and to learn something from this experience), all rated on a 7-point Likert scale, ranging from 0 (not at all) to 7 (very much). Perceived control over the angering situation (how much control did you have over the situation?) was rated on a 7-point Likert scale, ranging from 0 (not at all) to 7 (very much).

3.2.2.3. Procedure

After providing informed consent, participants completed a demographic questionnaire and the trait-anger measurement (STAXI-2, T-Anger). After receiving a careful explanation of the procedure and a video tutorial on using the Expiwell app used for data collection, participants were prompted 5 times a day, for 14 consecutive days, including weekends. Signals were sent randomly with a minimum of 90 minutes between blocks. After each prompt, participants had 20 min to respond before the survey became inactive, with any failure to respond being registered as missing data.

3.2.2.4. Data analysis plan

We first conducted intercept-only models to determine whether there was sufficient between-participants variance, warranting the use of multilevel modeling. The Intraclass Correlation Coefficients (ICC) obtained from these models indicated substantial between-group differences.

Considering the hierarchical structure of the data, we conducted multilevel modeling with the nlme package in R (Pinheiro et al., 2023) to investigate the relations between ER strategies and anger. This analysis enables the separation of between-cluster and within-cluster effects, while effectively addressing missing values. We employed group-mean centering and implemented a two-level model with random intercept and slope, with daily measurements at level 1 nested within individuals at level 2.

Ecological momentary assessment (EMA) methodology enables analysis of concurrent and lagged associations between ER strategies and momentary anger. To assess temporal precedence, a one-assessment lag was used, where ER strategies at Time 1 (T-1) were examined as predictors of changes in state-anger at Time 2 (T). To ensure that the lagged predictor did not occur the day before measurement of the outcome variable, all lagged analyses were limited within a day, in line with common practices and recommendations (Blanke et al., 2022).

Between-individual effects were disentangled from within-individual effects by using the participants' average across all assessments to estimate the between-individual effects and deviations from their own mean to estimate the within-individual effects. Both lagged and contemporaneous relations between ER strategies (independent variables) and state-anger (dependent variable) were estimated both at within- and between-individual levels. The relations between trait-anger (independent variable) and state-anger and ER strategies (dependent variables) were estimated at between-individual level, while the

moderating effect of ER motives and perceived control was estimated at within-individual level. Moderation analysis was conducted using the nlme package in R, with state-anger as the dependent variable and the interaction between each ER strategy and moderator (e.g., perceived control) as the primary predictor. We computed effect sizes for each predictor (e.g., ER strategy, moderator, and their interaction), providing insight into the proportion of variance explained by the moderation effect.

We visually inspected the degree of autocorrelation in the residuals for each model using the Autocorrelation Function (ACF) and adjusted for autocorrelation using first-order autocorrelation (AR1). The assumption of homogeneity of variance was evaluated by plotting standardized residuals against fitted values, with homogeneity indicated by a uniform distribution along the horizontal axis. The assumptions of linearity and normality were assessed with Q-Q plot, and supported if the points fitted a straight oblique line. We also generated histograms of the residuals to check if they displayed a normal distribution centered around zero. When a curved shape was displayed, indicating deviation form a normal distribution, we applied a natural logarithm transformation to the dependent variable.

In all models, we computed R^2 to quantify the extent to which changes in the dependent variables correspond to changes in the independent variables, both at the within- and between-individual levels.

3.2.3. Results

3.2.3.1. Descriptive and preliminary analyses

The average trait-anger score for all participants was 21.70, and 25.5% scored at or above the 75th percentile (26 points). The intra-class correlations (ICCs) ranged between .21 for rumination, and .56 for instrumental motives, indicating that there was variance in anger and ER.

3.2.3.2. Relations between ER strategies and trait-anger, and state-anger

We first investigated the associations between trait-anger and daily state-anger, and the use of ER strategies. At the between-individual level, trait-anger was significantly related to state-anger. As expected, participants with higher levels of trait-anger reported higher levels of everyday state-anger.

At the between-individual level, significant negative relations were observed between trait-anger and both acceptance and reappraisal. That is, people with higher levels of trait-anger tended to use less acceptance and reappraisal. No significant associations at the between-individual level were observed between trait-anger and avoidance, distraction, rumination and suppression.

3.2.3.3. Contemporaneous relations between ER strategies and state-anger

Between-individual acceptance and reappraisal predicted lower levels of state-anger concurrently, suggesting that participants who used acceptance and reappraisal more frequently compared to the overall sample experienced reduced levels of state-anger throughout the EMA protocol. In contrast, between-subjects rumination predicted higher levels of state-anger, concurrently.

At the within-individual level, acceptance, distraction and reappraisal were negatively associated with state-anger, whereas rumination was positively associated with state-anger. In other words, in situations in which rumination was increasingly used, and in which acceptance, distraction, and reappraisal were used at lower levels, higher levels of state-anger were experienced.

3.2.3.4. Prospective relations between ER strategies and state-anger

Between-individual rumination prospectively predicted higher levels of state-anger, while acceptance predicted lower subsequent anger levels. This suggests that participants who used rumination more frequently and used acceptance less frequently compared to the overall sample, experienced subsequent higher levels of state-anger.

At the within-individual level, only rumination used at an earlier time point predicted state-anger at a later time point. In other words, the extent to which an individual engaged in rumination predicted more state-anger experienced in the future.

3.2.3.5. The moderating effect of perceived control and ER motives

3.2.3.5.1. Perceived control.

When individuals perceived a diminished sense of control over the situation, they experienced more anger if they had engaged in more frequent rumination. In other words, when an individual perceived less control than usual, the more frequently they used rumination, the angrier they felt.

In contrast, in contexts in which a stressor was perceived as less controllable, avoidance was negatively related to anger. In other words, when an individual perceived less control than usual, using more avoidance predicted less anger.

3.2.3.5.2. ER motives.

When individuals were little motivated by hedonic motives, they experienced more anger if they had engaged in more frequent rumination. In other words, when an individual had less hedonic motives than usual, the more frequently they used rumination, the angrier they felt.

When individuals were little motivated by instrumental motives, they experienced more anger if they had engaged in more frequent rumination. In other words, when an individual had less instrumental motives than usual, the more frequently they used rumination, the angrier they felt.

3.2.4. Discussion

The present study extends EMA research on spontaneous anger regulation, with a key strength being its ecological validity. The use of ER strategies was assessed in a naturalistic context, reducing issues related to retrospective recall. Moreover, the two-week sampling period provided a more comprehensive understanding of anger regulation in daily life, offering insights into the individual patterns of anger regulation.

3.2.4.1. Trait-anger prediction

In line with previous research (e.g., Deffenbacher et al., 2016), our results indicated that at the between-subjects levels, trait-anger predicted daily state-anger, supporting the influence of individual differences in experiencing angry feelings (Edmondson et al., 2013).

Our hypothesis regarding the contemporaneous relations between different ER strategies and anger was partially confirmed. At the between-individual level, trait-anger was negatively associated with acceptance and reappraisal, but not with avoidance, distraction, rumination, suppression. These findings suggest that people with increased levels of trait-anger tend to use acceptance and reappraisal less frequently (Denson et al., 2012; Mauss et al., 2007). High trait-anger is associated with hostile attribution bias and rumination on hostile thoughts (Wilkowski & Robinson, 2010), possibly making high trait-anger individuals feel justified in their anger and perceive acceptance or reappraisal as a weakness or giving in.

Surprisingly, only reappraisal and acceptance were influenced by trait-anger, whereas other strategies (e.g., avoidance, suppression) were not. Individuals with high trait-anger may struggle to use effortful control resources for self-regulation, particularly affecting their ability to employ strategies such as reappraisal and acceptance (Wilkowski & Robinson, 2010).

3.2.4.2. EMA contemporaneous relations between use of ER strategies and state-anger

Results partly supported our hypotheses on the contemporaneous associations between the use of different ER strategies and state-anger. Specifically, acceptance and reappraisal were associated with reduced levels of anger, whereas rumination was associated with increased levels of anger, both at the between- and within-individual level. People who engaged more frequently in reappraisal and acceptance

and less in rumination, on a daily basis, experienced lower levels of anger than those who did not. Moreover, in situations where reappraisal and acceptance were increasingly used, and rumination reduced, there were lower levels of anger. These findings suggest that even if an individual typically uses anger regulation strategies that involve more rumination and less acceptance or reappraisal, when they do manage to shift this pattern their immediate feelings of anger are lower.

Interestingly, distraction was negatively associated with state-anger only at the within-individual level. This suggests that the effectiveness of distraction in reducing anger may be situation-dependent. Distraction may provide immediate relief from anger at a particular moment, but reliance on distraction across different situations may not be associated with long-term adaptation (Denson et al., 2012).

3.2.4.3. EMA prospective relations between use of ER strategies and state-anger

An important strength of the current study is addressing the research gap on how specific ER strategies predict future anger experiences (Boemo et al., 2022).

Acceptance predicted subsequent lower levels of anger across participants, while rumination predicted higher levels of state-anger both at the between- and within-individual levels (although the within-individual association was smaller). Whereas some previous data suggest that acceptance may have a downstream effect on provoked anger after a while, but not in the short-term (Germain & Kangas, 2015), our results suggest that frequent use of acceptance might be beneficial for both immediate and next-hour levels of anger. One potential explanation may be that the mechanisms entailed in acceptance (e.g., acknowledging emotions, reducing negative critical cognitions, decreasing blame tendency) involve a mindset shift that is intended for long-term use.

As for rumination, our findings are in line with a recent meta-analysis which found that, out of seven strategies, only rumination was significantly associated with subsequent negative affect (Boemo et al., 2022). Rumination is a vulnerability factor for exacerbated and prolonged negative emotions (Aldao et al., 2010). Although it may be employed with the intent to "solve" the problem, rumination involves ineffective processing, such as increased attention to the anger-inducing event, disregard of non-hostile clues, brooding over anger episodes (Borders & Giancola, 2011).

3.2.4.4. The moderating effect of perceived control and ER motives

Perceived control moderated the relation between rumination and anger, and avoidance and anger. When the stressor was perceived as less controllable, more anger was experienced if the person engaged in rumination, but less anger, if the person engaged in avoidance. One potential explanation is that when dealing with uncontrollable stressors, it might be more beneficial to use disengagement strategies such as avoidance which involve distancing oneself from the stressor (Socastro et al., 2022).

Hedonic and instrumental motives moderated the relation between rumination and anger. Individuals motivated by instrumental motives might use rumination to better understand the situation and to explore potential solutions, which might reduce the sense of helplessness and lead to lower levels of anger (Nolen-Hoeksema et al., 2008). Indeed, some forms of repetitive thinking are seen as potentially constructive, particularly when they focus on concrete details rather than abstract issues (Watkins, 2008). Moreover, when individuals see rumination as a problem-solving attempt, they may falsely believe that it will help them feel better (Wilms et al., 2020), which could explain why the association between rumination and anger is weaker when people are more motivated by hedonic motives. However as we did not distinguish between concrete and abstract forms of rumination, these explanations remain speculative.

Our findings should be interpreted in the light of several limitations. The small sample size affects the generalizability of the results, which is also limited by the uneven sex distribution, as the majority of participants were women. Another limitation is the use of only one item to assess each

construct of interest, except for ER motives. Although this approach aligns with previous studies (Boemo et al., 2022) and with recommendations to minimize participant burden due to multiple daily assessments (Myin-Germeys & Kuppens, 2022), future studies should consider using longer and validated measures. Another limitation is the grouping of pro-hedonic and contra-hedonic motives into a single hedonic measure based on the expectation of insufficient variance to reliably identify the motives underlying contra-hedonic regulation (Eldesouky & English, 2019). Finally, the design of the current study enables us to determine temporal relations between ER strategies and anger, but their correlational nature does not allow any causal conclusions about these variables.

To conclude, this study contributes to understanding the role of ER strategies in the experience of anger in daily life, reinforcing the view that ER is a key mechanism underlying dysregulated anger.

3.3. Study 3. Online emotion regulation-based intervention for reducing anger: a randomized controlled trial

3.3.1. Introduction

Anger is one of the basic human emotions that varies in intensity and duration, being experienced along a spectrum that spans from healthy to dysfunctional, and pragmatic to problematic (Del Vecchio & O'Leary, 2004; Saini, 2009). When anger becomes excessive, disproportionate, or dysfunctional, it is linked with both physical and mental health problems (Cassiello-Robbins & Barlow, 2016; Saini, 2009). The scientific literature makes a distinction between trait-anger (a relatively stable tendency to feel angry) and state-anger (a transitory response to an immediate stimulus; Spielberger, 1988). High trait-anger individuals report greater state-anger in particular situations, more negative cognitions, and more negative mental health outcomes (Germain & Kangas, 2015; Veenstra et al., 2018). The relationship between anger and mental health problems may be underpinned by emotion regulation (Garofalo et al., 2016; Mancke et al., 2017). Emotion regulation (ER) consists of processes involved in modulating the occurrence, intensity, and duration of emotional experiences and expressions (Campbell-Sills & Barlow, 2007).

One of the most commonly studied ER strategies is cognitive reappraisal. Being fundamental to the cognitive behavioral therapy (CBT) framework (Clark, 2022), cognitive reappraisal refers to altering an emotional response by reinterpreting the significance of an event or stimulus (McRae et al., 2012). An alternate ER strategy is acceptance, which derives from the acceptance-and-commitment therapy (ACT) framework (Hayes et al., 1999). Acceptance is conceptualized as "the active and aware embrace" of emotions which allows them to exist naturally (Hayes et al., 2006, p.14).

Findings from the literature suggest that individuals who engage in reappraisal tend to experience less anger compared to those who do not. Although experimental evidence indicates that instructed reappraisal leads to decreased levels of anger (e.g., Peuters et al., 2019), only a few studies compared reappraisal to a control condition (Denson et al., 2011; Denson et al., 2012; DiBlasi & Sinn, 2024; Szasz et al., 2016). Two studies showed lower levels of anger in the reappraisal group compared to the control group (Denson et al., 2011; Szasz et al., 2016), whereas another study found that reappraisal reduced anger to a lesser extent than the control group (Denson et al., 2012). DiBlasi and Sinn (2024) also found that a reappraisal-based intervention reduced momentary anger; however, its effects were not significantly different from those of the control condition, which involved a distraction-based task. These mixed data limit the interpretation of the true direction of effects observed in the studies. Moreover, findings were limited to the immediate or short-term effect (24-hour follow-up period) of reappraisal. Examining the effects over a longer period of time is essential to understand the sustainability of a reappraisal-based

intervention's impact, especially considering that reappraisal demands significant cognitive resources (Gan et al., 2017).

More recently, several researchers have proposed acceptance as an alternative ER strategy for reducing anger (Donahue et al., 2017; Eifert & Forsyth, 2011). Acceptance requires fewer cognitive resources than reappraisal and is perceived as less difficult to employ (Keng et al., 2013). Two studies (Szasz et al., 2011; 2016) investigating the effects of reappraisal, acceptance, and suppression on experimentally-induced anger reported that participants who employed acceptance experienced reductions in anger, but to a lesser extent than those who used reappraisal. Germain and Kangas (2015) conducted a study under similar conditions among individuals with high trait-anger. They found that individuals who deployed acceptance did not experience a significant immediate decrease in momentary anger (i.e., state-anger), but rather at 24-hour follow-up. However, no significant difference was observed between the three conditions at follow-up. Given the mixed results on the effectiveness of acceptance in reducing anger, the absence of comparison with a control group, and the limited research on the long-term impact of both acceptance and cognitive reappraisal, our study aimed to provide further insight into this topic.

3.3.1.1. Present Study

Despite indications of the high prevalence of anger problems(Lachmund et al., 2005), many individuals struggling with anger problems still do not seek in-person treatment (Howie & Malouff, 2014). Online programs targeting anger, though few, show promise as an accessible and effective intervention for reducing problematic anger (DiBlasi & Sinn, 2024). In this study, we aimed to examine the short- and long-term effects of an online intervention in reducing state- and trait-anger in adults with elevated levels of trait-anger. Individuals were instructed to engage in either reappraisal, acceptance, or active-control condition. The authors posited the following hypothesis:

H1: The online reappraisal intervention will lead to a greater reduction in state- and trait-anger in the reappraisal-intervention group as compared to the control group;

H2: The online acceptance intervention will lead to a greater reduction in state- and trait-anger in the acceptance-intervention group as compared to the control group;

H3: The effects of the selected strategies on trait-anger (i.e., reappraisal, acceptance) will persist at 1-month follow-up.

3.3.2. Method

Following established open science practices, a pre-registration of the study protocol was deposited within the Open Science Framework (OSF) Registries, available at https://doi.org/10.17605/OSF.IO/CU2XA.

3.3.2.1. Participants

Subsequent to institutional ethics approval, we recruited adults (aged 18 years or older) who scored high on trait-anger (at or above the 75th percentile on the Trait-Anger Scale of the STAXI-2; Spielberger, 1988).Exclusion criteria included current suicidal or homicidal ideation, and ongoing psychotherapy or psychiatric hospitalization. Our final sample consisted of 78 Romanian participants (75 women, mean age = 36.22 years, SD = 9.38). In terms of education, 16.7% had completed high school, 33.3% held a bachelor's degree, 42.3% had a master's degree, and 7.7% had obtained a doctoral degree.

Sample sizes were calculated in order to ensure sufficient power for detecting between-group differences in self-reports of angry affect at α = .05 and moderate to large effect sizes (i.e., 25–30; Cohen, 1992). Participants were randomly assigned to the active control and experimental groups (N=30 in the acceptance group, N=26 in the reappraisal group, and N=22 in the control group).

3.3.2.2. Instruments

3.3.2.2.1. The State-Trait Anger Expression Inventory-2, Trait Anger subscale - Romanian version (Pitariu & Iliescu, 2006) is a 10-item instrument that measures the general tendency to experience anger across time and situations. Participants answered on a 4-point scale ranging from 1 (not at all) to 4 (a lot). In our study, the Trait-Anger subscale had good internal consistency at each measurement time-point (T1: $\alpha = .87$; T2: $\alpha = .84$; T3: $\alpha = .85$).

3.3.2.2.2. The State-Trait Anger Expression Inventory-2, State Anger subscale - Romanian version (Pitariu & Iliescu, 2006) is a 15-item instrument that assesses anger intensity at the moment of answering the questionnaire. The statements are rated on a scale ranging from 1 (not at all) to 4 (a lot). Internal consistency was good at each measurement time-point (T1: $\alpha = .95$; T2: $\alpha = .93$; T3: $\alpha = .94$).

3.3.2.3. Procedure

Eligible participants completed the pre-test instruments, before being randomly assigned to one of three conditions: acceptance, reappraisal, or control. Participants in both experimental conditions (i.e., acceptance, reappraisal) received a two-hour online training on either acceptance or reappraisal. The Control group received only the practice phase. Trait-anger was measured at 3 time-points: prior to intervention (before participants were randomly assigned to one of the three conditions), after intervention (following the completion of the practice phase), and at 1-month follow-up. State-anger was measured 3 times during each of the 6 sessions, for a total of 18 assessments.

Practice phase.

The practice phase consisted of 6 online sessions, each spaced 2 days apart and containing the following components: *(a) Questionnaires*: At each session, participants completed state anger assessments before anger induction, immediately after anger induction and after implementing the instructions; *(b) Anger induction:* Participants in all three conditions were asked to think of, and describe in an online form, a situation when they experienced anger, either the most recent or the most intense angry situation; *(c) Instructions:* The instructions for the reappraisal group were based on the CBT/RBT model (David, 2006), while the instructions for the acceptance group were derived from ACT-based techniques (Hayes et al., 1999). The instructions for the control group were adapted from Nan (2017).

Several considerations prompted our selection of six sessions. First, studies of memory consolidation indicate that it takes several days for the learned material to be integrated into activated neural networks (McGaugh, 2000). Second, literature shows that repetition facilitates the strong connection between neurons involved in encoding, enhancing memory consolidation (Himmer et al., 2019); *(d) Feedback:* After each session, participants received personalized and confidential feedback on the manner they implemented the instructions.

3.3.3. Results

3.3.3.1. Effects of emotion regulation interventions on state-anger

Linear mixed models were performed to investigate the effects of the interventions on state-anger using the statistical package JASP. Group (acceptance; reappraisal; control) and time (baseline; post-induction; post-instructions) were introduced as fixed effects and the random individual variation was accounted for. Models revealed a significant effect of the time ($F(2, 75) = 46.20$, $p < .001$), but no significant effect of the group, nor of the group and time interaction for state-anger. State-anger scores increased from baseline (time 1) to post-induction (time 2), then decreased to post-instruction (time 3) across groups, suggesting reduced state-anger following instruction implementation.

3.3.3.2. Effects of emotion regulation interventions on trait-anger

A 3 (condition: acceptance, reappraisal, control) x 3 (time: pre-, post-, 1-month follow-up) mixed ANOVA was conducted to compare the effects on trait-anger. There was a strong main effect for time,

Wilks Lambda = .48, $F(2, 74) = 38.97$, $p < .001$, partial $\eta2 = .51$. However, the interaction between ER condition and time, and the main effect for the group were not significant. Post-hoc analysis (Bonferroni test) of the main effect for time showed that trait-anger significantly reduced from baseline (T1) to both post-intervention (T2) (mean difference: 3.99, SE = .47, $p < .001$), and 1-month follow-up (T3) assessments (mean difference: 4.39, SE = .57, $p < .001$). This pattern of decrease was observed across all the conditions being investigated.

3.3.3.3. Manipulation check

To check the efficacy of anger memory recall in increasing momentary anger, we calculated scores for state-anger after induction. The results demonstrated that the manipulation was successful. Moreover, participants received feedback on the effectiveness of their strategy implementation, along with specific guidance for subsequent tasks.

3.3.4. Discussion

Our study aimed to investigate whether an online emotion regulation-based intervention is efficient in reducing both state- and trait-anger.

3.3.4.1. Null findings

Acceptance- and reappraisal-based online interventions contributed to significant changes in state- and trait-anger across time. However, the results did not support our hypothesis regarding a greater reduction in both types of anger after using reappraisal and acceptance as compared to simply acting neutrally about the event. One potential explanation is that the instructions provided to the active-control group may have served as guidelines for implementing distraction, as observed in another study (Denson et al., 2012). Several studies support the effectiveness of distraction in reducing anger, largely due to its ease of implementation (Bushman et al., 2005; Denson et al., 2012). While distraction may indeed prevent individuals from processing the anger-inducing event, it also disrupts rumination (Neumann et al., 2004) which has consistently been shown to increase anger (Offredi et al., 2016). Distraction is a common anger regulation strategy that warrants further research.

Another potential explanation for the null outcomes regarding both state- and trait-anger may lie in the limited duration of the intervention, which may not have enabled a broad shift in perspectives (reappraisal) or a comprehensive acceptance and tolerance of negative feelings. While we aimed at investigating an online intensive time-limited intervention, deeper internalization of reappraisal and acceptance likely requires a more extended intervention time. Particularly if targeting trait-anger, a stable tendency to experience anger (Veenstra et al., 2018), longer intervention time may be more appropriate.

Despite the potential explanations, the null outcomes suggest that the observed changes in both trait- and state-anger that across time in all groups may be attributed to the participants' expectations or to the general sense of support from the research team, rather than the specific strategy they were instructed to use. Future research should investigate the participants' expectations and perceptions of support to determine the extent to which these factors may contribute to the observed reduced anger. Interventions may benefit from incorporating elements that enhance perceived support and motivation, rather than relying solely on teaching new strategies. Additionally, understanding the role of expectations could improve how therapeutic techniques are introduced and applied in practice.

3.3.4.2. Limitations

Several methodological limitations warrant consideration when interpreting the current findings. The reliance on self-reported assessments represents a limitation. Future studies should consider integrating a multimodal assessment approach to anger, including observer-reported assessments.

The gender imbalance (75 of the 78 participants were women) is another limitation of the current study. One potential explanation is related to gender roles: women are generally less expected to express anger (Fischer & Evers, 2011), and therefore, they may have been more motivated to participate in the two-week intervention. Future studies should aim to recruit more gender-balanced samples to ensure the findings are generalizable to both men and women.

While a 1-month follow-up was a strength of the study, extending the follow-up period to include longer-term assessments would provide additional insights.

Lastly, the high drop-out rate (32.17%) resulted in a smaller sample size, limiting our ability to detect small to medium effect sizes and only allowing for the identification of large effects for potential between-group differences (Lovakov & Agadullina, 2021).

Participants may have felt bored by the experimental task itself, which involved applying the same instructions, delivered in a text format. Future ER strategies-based interventions should consider more engaging content, such as interactive exercises, explanatory videos and images.

In conclusion, while the results of this study did not confirm our initial hypothesis, it is essential to recognize that null findings play a pivotal role in advancing scientific knowledge. Presenting these results contribute to a more transparent, comprehensive body of literature on anger regulation, helping to reduce the publication bias that can skew our understanding of the research landscape. These findings also provide valuable insights that may inspire future research to refine our approaches.

3.4. Study 4. Anger and Expressive Flexibility: Risk Factors for Psychopathology?
3.4.1. Introduction

Anger serves an adaptive function by mobilizing psychological resources to change stressful situations (Ahmed et al., 2012; Ciesinski et al., 2022) and motivating individuals to address unfair treatment (Harmon-Jones et al., 2009). However, it is also closely related to aggressive behavior, particularly when poorly regulated (DeWall et al., 2011). Dysregulated anger has also been documented in numerous psychiatric conditions, including trauma-related, mood, and personality disorders (Cassiello-Robbins & Barlow, 2016; Fernandez & Johnson, 2016). Given the important role anger plays in psychopathology, it is crucial to develop robust experimental paradigms that can reliably evoke and measure anger within interpersonal contexts. Such an evaluation method proposed for examining anger and its aggressive manifestation is the Ultimatum Game (UG; Güth et al., 1982).

The original UG paradigm involves a bargaining situation between two players: a responder who decides whether to accept or reject offers from another player who proposes how an amount of money should be split between them. If accepted, both players receive the proposed amounts; if rejected, neither receives any money. Empirical findings indicate that unfair offers – typically below 20–30% of the total amount – are frequently rejected, driven by perceived injustice and anger (Sanfey et al., 2003). Building on this framework, the anger-infused version of the UG (AI-UG), created by Gilam and colleagues (2019), introduces interpersonal provocations as short written messages, alongside monetary offers, designed to evoke an authentic angering social interaction.

This study aimed to examine the role of the Anger-infused Ultimatum Game in eliciting and evaluating a genuine anger experience and to investigate the involvement of expressive flexibility in the relation between childhood maltreatment and psychopathology.

3.4.1.1. Anger, acceptance behavior and unfairness

Prior research has demonstrated that receiving unfair offers in the UG primarily elicits anger (Xiao & Houser, 2005), which, in turn, drives rejections decisions (Gilam et al., 2015). Rejection in this

context is often interpreted as an aggressive response towards the proposer, who is perceived as attempting to exploit others (Nowak et al., 2000). Individuals with high trait anger – a stable predisposition to react with anger (Spielberger, 1988) – have been shown to engage in more aggressive and punitive behaviors (Ask & Pina, 2011), including increased rejection rates in the UG (Rodrigues et al., 2022). It is plausible that individuals with higher trait anger perceive unfair offers as more provoking, leading to stronger emotional reactions and a lower likelihood of offer.

Building on these findings, we expected that the type of offer would influence both emotional responses and decision-making, with these effects being sensitive to individual differences in trait anger. Accordingly, we proposed the following hypotheses:

H1a. Participants will accept unfair offers at a lower rate compared to medium, or fair offers.

H1b. Participants will report higher levels of anger in response to unfair offers compared to medium, or fair offers.

H1c. Trait anger will predict an increase in anger in response to unfair offers.

3.4.1.2. Anger, acceptance behavior and emotional expression

One important question is whether emotional expression influences outcomes in interpersonal contexts. Several studies investigated how one player's emotional display affects the opponent's decision-making in UG (e.g., Ferracci et al., 2021), suggesting that expressing anger can lead to either less fair offers from proposers or lower acceptance rates from responders. However, only a few studies have explored how an individual's emotional expression affects *their* own decision-making and emotional experience. For instance, Xiao and Houser (2005) found that participants who could express their emotions towards the proposer concurrently with their decisions were more likely to accept unfair offers. Nevertheless, when anger expression is not visible *to the counterpart* and cannot serve as a punitive act, it may fail to reduce emotional intensity or influence rejection behavior. One study (van't Wout et al., 2010) demonstrated that emotion suppression during the UG did not significantly alter the emotional responses elicited in social interactions nor influenced the acceptance rate.

Expanding on prior research, we expected that the acceptance rate of unfair offers would be influenced solely by the degree of unfairness (i.e., type of offer), regardless of the emotion regulation condition (i.e., suppression, expression, control). Given the manipulation of emotion regulation conditions, we expected that an external observer would report lower levels of anger for participants in the suppression condition compared to control and enhancement conditions, in response to unfair offers. Thus, we formulated the following hypotheses:

H2a. Participants across all emotion regulation conditions (suppression, enhancement, control) will report comparable levels of anger.

H2b. Participants will accept unfair offers at a lower rate compared to medium, or fair offers, irrespective of the emotion regulation condition.

H3. Lower levels of anger will be reported by external observers for participants in suppression condition compared to control or enhancement conditions, when responding to unfair offers.

3.4.1.3. Expressive flexibility, childhood maltreatment, psychopathology

The link between anger and psychopathology has been attributed to emotion regulation mechanisms (Gardner & Moore, 2008; Roberton et al., 2012). Dysfunctional emotion regulation (ER) has been identified as a key factor for psychiatric disorders (Fernandez et al., 2016; Gross & Munoz, 1995).

Recent research perspectives have shifted from the habitual use of ER to the flexibility with which individuals adapt their regulation efforts to contextual challenges (Aldao et al., 2015). This perspective highlights the importance of expressive flexibility (EF) – a form of ER flexibility – which

may be critical for complex social interactions and psychological well-being. Indeed, EF deficits have been associated with greater severity of PTSD and depressive symptoms among combat veterans, prolonged grief reactions, and greater levels of depressive symptoms (Gupta & Bonanno, 2011; Pițur & Miu, 2020; Rodin et al., 2017). Childhood maltreatment has been recognised as another risk factor for psychopathology (Green et al., 2010). Moreover, although scarce, there is evidence that childhood maltreatment also impacts expressive flexibility, suggesting the involvement of expressive flexibility in the relation between childhood maltreatment and psychopathology (Pițur & Miu, 2020).

We investigated whether expressive flexibility mediates the relationship between maltreatment and psychopathology, loneliness, and alcohol-related problems. We proposed the following hypotheses:

H4. Childhood maltreatment is positively associated with expressive flexibility.

H5. Expressive flexibility mediates the association between childhood maltreatment and psychopathology.

3.4.2. Method

3.4.2.1. Participants

One hundred and twelve undergraduate students (98 females, 14 men) participated in the present study. Participation was voluntary and students received course credit for their involvement. Two participants were excluded due to video recording issues, and indication of knowing the hypotheses. The remaining participants (97 females, 13 males) ranged in age from 18 to 47 (M = 20.25, SD = 3.76). The study was approved by the Institutional Ethics Committee, and written informed consent was obtained.

3.4.2.2. Measures

3.4.2.2.1. Trait anger.

We used the Trait Anger subscale of the State-Trait Expression Inventory-2 (STAXI-2; Spielberger, 1999), a widely used self-report measure designed to assess the tendency to experience anger across situations. Participants responded on a 4-point Likert (1 = not at all to 4 = a lot). In the present study, the Trait Anger subscale indicated very good reliability, with Cronbach's alpha of 0.85.

3.4.2.2.2. Childhood maltreatment.

We used the short form of Childhood Trauma Questionnaire (CTQ; Bernstein et al., 2003) to measure the extent to which individuals had experienced multiple forms of abuse and neglect experienced during childhood. Responses were given on a 5-point Likert scale ranging from 1 (never) to 5 (very often true). A total maltreatment score was calculated, which showed very good reliability in this sample (Cronbach's alpha = 0.88).

3.4.2.2.3. Psychopathology symptoms.

The Symptom Checklist-90 (Derogatis et al., 1973) was used to evaluate general psychopathological complaints. The instrument includes nine clinical subscales, measuring symptoms of depression, anxiety, hostility, somatization, obsessive-compulsive tendencies, interpersonal sensitivity, phobic anxiety, paranoid ideation, and psychoticism. Each item is rated on a 4-point Likert scale (0 = not at all to 4 = extremely). A global index of overall psychological distress is calculated by averaging the scores of all 90 items. Cronbach's alpha for this instrument showed excellent reliability ($\alpha = 0.98$).

3.4.2.3. General procedure

Upon enrollment, participants provided demographic information and were screened for eligibility, which required them to be adults (18 years or older) and available for the laboratory-based session. Participants received an online survey that included baseline assessments of childhood maltreatment and psychopathology symptoms, then participated in an individual laboratory session. Each session began with an assessment of trait anger (STAXI-2; Spielberger, 1999). The experimenter

provided a detailed explanation of the UG rules, followed by a practice round. To ensure task comprehension, participants were also given on-screen instructions throughout the game.

At one-month and three-month follow-ups participants completed an additional online survey assessing psychopathology symptoms.

3.4.2.3.1. Ultimatum Game.

Participants were informed that they would take on the role of responders in the Ultimatum Game. They would receive monetary offers ranging between 20 and 30 RON (approximately 4.2–6.3 USD), randomly selected from a database of offers, each accompanied by a message purportedly given by previous participants. They were told that their objective was to maximize their earnings.

The game comprised 9 rounds, structured by evenly combining emotion regulation condition (i.e., suppression, enhancement, control) with offer type (i.e., fair: responder is offered 40%–50% of the total sum; medium: 25%–35% of the total; unfair: 10%–20% of the total).

At the beginning of each round, participants were instructed to either react naturally or to modulate their emotional expressions by suppressing or enhancing them (see Expressive flexibility paradigm). Next, an offer was presented, which also included the message and initials of the purported proposer. Participants had then to decide, using a keyboard press, to accept or reject the offer. Then, the result of the decision was displayed: If the offer was accepted, the earnings were split accordingly; if rejected, both players received zero. To encourage intuitive decision-making, participants were instructed beforehand that if they failed to respond within the time limit, the offer would be automatically rejected.

Following each round, participants self-reported their emotional state, rating four emotion categories (i.e., anger, fear, happiness, sadness) on a 0–10 scale. The inclusion of multiple emotion categories prevented a bias toward anger and allowed for the assessment of other potentially relevant emotions in the UG (e.g., Gilam et al., 2019).

Upon completing the task, participants had the option to anonymously submit their own offer and accompanying message, ostensibly to be added to the database of future offers.

3.4.2.3.2. Expressive flexibility paradigm.

Expressive flexibility, defined as the ability to modulate emotional expression both upward and downward, was assessed using an experimental paradigm developed by Bonanno and collaborators (2004), integrated in the UG. In each round, participants were asked to either respond naturally to the offers or to suppress or enhance their emotional expressions. These requirements were given under the pretense that an assigned observer, tasked with guessing their emotions, would periodically view them via webcam. A separate group of undergraduate students, unaware of the study's hypotheses, evaluated video recordings of the participants' emotional expression. Using a custom-designed task, these observers rated the intensity of anger, fear, sadness and happiness displayed by participants, on a 10-point Likert scale.

To quantify EF, scores were computed as the sum of enhancement and suppression scores minus their absolute difference, following previous approaches (see Westphal et al., 2010).

3.4.3. Results

3.4.3.1. Offer acceptance rate

To examine offer acceptance rates in different offer types, we performed a univariate ANOVA 3x3, with Offer Type (Fair, Medium, Unfair) and ER Condition (Suppress, Enhance, Control) as between-subjects factors. This analysis revealed a significant main effect of Offer Type, $F(2, 981) = 246.717$, $p < .001$, $\eta_p^2 = .335$. Confirming our hypothesis, no main or interaction effects of ER Condition emerged, ps > .90, indicating that the effect of offer type on acceptance rates was not influenced by ER experimental conditions. Games-Howell post-hoc tests indicated significant differences between all three offer types (p

< .001), with acceptance rate decreasing as offer unfairness increased (Fair: M = .810, SD = .01; Medium: M = .532, SD = .016, Unfair: M = .317, SD = .016).

3.4.3.2. Self-reported anger

3.4.3.2.1. Manipulation checks.

We selected the Wilcoxon signed-rank test to determine whether there was a significant change in anger levels from before the game to during the unfair offers. The findings signalled a significant increase in anger, rising from M = .76, SD = 1.24 before the game to M = 3.49, SD = 2.86 during the unfair offers. We also used Wilcoxon signed-rank tests to compare anger levels to other assessed emotions in response to unfair offers. The results confirmed that anger (M = 3.49, SD = 2.86) was significantly greater than fear (M = 1.02, SD = 1.62), sadness (M = 1.83, SD = 2.24), and joy (M = 2.39, SD = 2.29).

3.4.3.2.2. Main analysis.

A two-factor analysis of variance (ANOVA) was conducted to examine the effects of Offer Type (Fair, Medium, Unfair) and ER Condition (Suppress, Enhance, Control) on self-reported anger levels. A significant main effect of Offer Type was found, $F(2, 980)$ = 66.574, $p < .001$, η_p^2=.120, indicating that the fairness of the offer strongly influenced anger experience during the AI-UG. However, neither the main effect of ER Condition, nor the interaction between Offer Type and ER Condition was significant (ps > .60). Games-Howell follow-up tests, which correct for unequal variances (Ramsey et al., 2010), revealed significant differences between all offer types ($p < .001$). The highest anger levels were reported in Unfair offers (M = 3.49, SD = 2.86), which were greater than those in Medium offers (M = 2.64, SD = 2.51), and Fair offers (M = 1.32, SD = 1.80). Medium offers also resulted in significantly higher anger ratings compared to Fair offers ($p < .001$, see Figure 2).

A three-stage hierarchical multiple linear regression analysis was conducted to examine the effects of trait anger, offer type, and their interaction on anger levels. Trait anger significantly predicted anger levels (R^2 = .102, $\square$(1, 987) = 112.21, $\square < .001$), and the addition of offer type increased the explained variance to 21.9% (ΔR^2 = .117 , $F(2, 986)$ = 138.57, $\square < .001$), with both predictors being significant ($\square$ = 0.170 for trait anger, $\square$ = 1.085 for offer type, both $\square < .001$). Including the interaction term, which was significant ($\square$ = 0.050, $\square$ = .007), further improved the model (ΔR^2 = .006, $\square$(3, 985) = 95.46, $\square < .001$).

3.4.3.3. Other-reported anger

To assess the external observers' ratings of anger, we conducted a two-way ANOVA 3 (ER Condition: Suppress, Enhance, Control) x 3 (Offer Type: Fair, Medium, Unfair) to which we submitted the averaged observer ratings for anger. The results showed a significant main effect of ER Condition ($F(2, 981)$ = 123.161, $p < .001$, η_p^2 = .201), a significant main effect of Offer Type ($F(2, 981)$ = 21.053, $p < .001$, η_p^2 = .041), and a significant interaction effect between the two factors ($F(4, 981)$ = 9.646, $p < .001$, η_p^2 = .038). Post-hoc tests indicated that, in response to unfair offers, participants in the suppression condition (M = 1.404, SE = 0.12) were rated as significantly less angry than those in the control (M = 2.171, SE = 0.126, $p < .001$) and enhancement conditions (M = 3.565, SE = 0.126, $p < .001$).

3.4.3.4. Expressive flexibility

We run a Pearson correlation to test the relation between childhood maltreatment and expressive flexibility. The results showed no significant association, $r(328)$ = .03, p = .632, 95% CI [-.082, .134]. Further, a linear mixed-effects model, conducted in R Studio (RStudio Team, 2023), showed that expressive flexibility was not a significant predictor of childhood maltreatment, b = 0.05, SE = 0.04, $t(108)$ = 1.18, p = .242, rendering meditation analysis unnecessary. However, results indicated a significant main effect of childhood maltreatment, b = 0.02, SE = 0.003, $t(108)$ = 6.69, $p < .001$, and a

significant interaction effect between time and the latter on psychological distress, $b = 0.002$, $SE = 0.0007$, $t(191) = 3.39$, $p < .001$. These findings suggest that individuals with higher levels of childhood adversity experienced greater psychological distress, with distress trajectories differing based on maltreatment levels.

3.4.4. Discussion

The present findings provide empirical support for the effectiveness of this version of the UG in eliciting anger in response to unfair offers. Participants experienced a significant increase in anger from baseline levels to levels during the unfair offers, a change that was substantially larger than the increase observed in sadness and the decreases observed in fear and joy. Thus, the possibility that the AI-UG broadly influences mood is challenged, whereas the specific impact it has on anger is supported. These findings confirm that the AI-UG successfully simulates real-world interpersonal provocations that primarily trigger anger responses, reinforcing the validity of this method as an ecologically relevant paradigm for inducing and assessing anger.

3.4.4.1. Anger, acceptance behavior and unfairness

Our findings demonstrate that participants accepted unfair offers at lower rates compared to medium and fair offers, paralleled by an increase in reported anger. Previous research has argued that fairness elicits anger which leads to retaliatory actions, such as rejecting unfair offers, and has considered anger a pivotal emotional driver behind such decisions (Liu et al., 2016). However, our mediation results show that anger only partially explained the impact of offer type (i.e., unfair, medium fair, fair) on acceptance rate. The indirect influence of offer type on acceptance rate is potentially due to the perception of injustice which can consistently elicit anger, that is predictive of rejection actions (Nowak et al., 2000; Sanfey et al., 2003). Another potential mechanism for the induction of anger and the subsequent rejection behavior is the inclusion of angering messages in the version proposed by Gilam and colleagues (2019). These messages likely shaped the perceptions of malicious intent, making the proposer appear more culpable and, in turn, evoking anger responses and punitive intentions (Cramer et al., 2010).

The direct effect of offer type on acceptance behavior, independent of anger, could be explained by the activation of neurobiological and cognitive pathways that directly influence decision-making. Previous research suggests that rejection behavior may stem not exclusively from emotional reactions but also directly from automatic appraisals of fairness violation (Klimecki et al., 2016). Moreover, van den Bos and colleagues (2009) have shown that offer type significantly engages specific brain regions that can lead to direct behavioral outcomes such as acceptance or rejection. Another potential explanation for these results is that anger is not the only emotion driving rejection as a form of active punishment. Reward-related emotions such as malicious joy may also contribute (Klimecki et al., 2016), particularly when individuals take pleasure in knowing that unfair people suffer (de Quervain et al., 2004).

Our hypothesis regarding the predictive role of trait anger was partially supported, with results indicating that trait anger predicted increased anger responses to unfair offers, but not lower acceptance rates. The strong relation between trait anger and the momentary experience of anger is supported by numerous studies (Deffenbacher et al., 2000). However, the results regarding the predictive role of trait anger in acceptance behavior may seem surprising, given its well-established association with aggressive behavior (Quan et al., 2022). Notably, other research has also failed to find a significant link between trait anger and aggression, which may be attributed to the absence of situational trait activation (Rodrigues et al., 2021). In the context of the UG, the variety of offers may have prevented a consistent activation of trait anger. It is possible that participants rejected offers not solely out of anger but also due to an expectation that better offers would follow (Rodrigues et al., 2022).

Regarding the observed anger, our hypothesis was validated; external observers reported lower levels of anger for participants in the suppression condition compared to those in the control or enhancement conditions, when responding to unfair offers.

3.4.4.2. Expressive flexibility

The findings do not support a significant association between childhood maltreatment and expressive flexibility, nor the mediation of the relation between childhood maltreatment and psychological through expressive flexibility. One possible explanation is the importance of the time period at which the maltreatment occurred. Individuals maltreated at earlier ages might experience greater disruptions in ER development, while those affected later might exhibit better expressive flexibility due to potential compensatory mechanisms, such as enhanced social support (Armbruster-Genç et al., 2024). The lack of a significant mediation effect of expressive flexibility in the relation between childhood maltreatment and psychopathology might be due to the relatively mild levels of both childhood maltreatment and psychological symptoms within the current sample. These lower levels may have hindered the detection of potential relations, given that several maltreatment-related cognitive biases and emotional difficulties often become evident in individuals only under specific circumstances, such as depressive episodes, or after stressful life events (Günther et al., 2015). Given that our study included a non-clinical sample, these interpretations remain tentative and highlight the need for further research in populations with more severe symptomatology. Moreover, expressive flexibility is not entirely fixed and can be shaped by later experiences, such as therapy or interpersonal relationships (Malkoç et al., 2019).

However, our findings revealed that childhood maltreatment predicted both higher levels of psychopathology and its increase in time, aligning with previous research (Baldwin et al., 2024; Xiao et al., 2023). These results underscore the long-term impact of early childhood maltreatment and highlight the need for targeted interventions to mitigate its effects.

3.4.4.3. Limitations

The low representation of men in our sample, which do not allow for generalizability across sexes, is one limitation of our study. Another limitation is that we did not include individuals with psychopathology while a clinical sample might be more appropriate for detecting relations between expressive flexibility, childhood maltreatment and psychopathology.

In conclusion, the current findings support the effectiveness of the Anger-infused Ultimatum Game in inducing anger within a realistic social context, and provide further support for the role of childhood maltreatment in the development of psychopathology, while warranting for future research on the differential impact of early versus later childhood maltreatment on anger-related expressive flexibility.

CHAPTER IV. GENERAL CONCLUSIONS AND IMPLICATIONS

The current thesis aimed to examine the regulation of anger, the role of contextualized factors in shaping it, and the relation between anger regulation and psychopathology.

It has been stated that emotion regulation is a cornerstone in research on problematic anger, but the existing data do not provide clear evidence regarding the significance and magnitude of the relations between specific emotion regulation strategies and anger. To address these gaps in literature, this research project started with a meta-analysis to clarify the nature and magnitude of the associations between anger and specific emotion regulation strategies. Given that most studies reviewed in our meta-analytical work relied on single retrospective assessments, we extended our research project by assessing the relations between anger and emotion regulation strategies in real-world settings, while accounting for contextual factors as well. This was achieved through employing the Ecological Momentary Assessment (EMA)

method, which allowed us to capture the dynamic relationship between anger and emotion regulation as it unfolds in daily life. Consistent with the meta-analytic findings, EMA results showed that among the six emotion regulation strategies examined, reappraisal and acceptance were concurrently associated with anger, with only acceptance demonstrating a negative lagged association. Building on these findings, the next phase of this research project focused on investigating the effectiveness of reappraisal and acceptance in reducing anger through an online intervention targeting individuals with high trait anger.

According to our meta-analytic findings, the habitual use of avoidance, rumination, and suppression are positively linked to anger. Given that persistent use of the same strategies across-contexts has been linked to ER inflexibility (e.g., Elkjær et al., 2022) – a factor associated with several psychopathology symptoms –, our next efforts were concentrated on investigating expressive flexibility – a form of emotion regulation flexibility – in an angering context. We also aimed to examine whether expressive flexibility serves as a potential mechanism underlying psychopathology.

By integrating findings from meta-analytical, ecological, and experimental approaches, this thesis contributes to a more comprehensive understanding of anger regulation and its implications for psychopathology. The theoretical, clinical and methodological advances that this thesis brings forward are discussed in the following section.

4.1. Theoretical, Conceptual and Clinical Implications

This thesis addresses key questions in the literature regarding the role that emotion regulation plays in understanding and managing problematic anger.

In the first study, we conducted a meta-analysis of the associations between anger and emotion regulation strategies. To our knowledge, this is the first meta-analysis to systematically synthesize existing research on the topic. The results of this meta-analysis demonstrated that anger is consistently associated with the differential use of multiple emotion regulation strategies; specifically, positively associated with avoidance, rumination and suppression, whereas negatively associated with acceptance and reappraisal.

Given that habitual and momentary use of ER are distinct, although modestly correlated, (Chen et al., 2024), we aimed to extend the meta-analytical work by conducting a study that focused on spontaneous anger regulation. Recent research directions have suggested that individual variability and contextual factors may influence spontaneous emotion regulation, and, therefore, should be considered when examining regulatory processes (Bonanno & Burton, 2013). Following this direction, we tested whether perceived controllability of a situation and ER motives (i.e., hedonic and instrumental) moderate the relations between anger and the momentary use of ER strategy. Results indicated that when engaging more in reappraisal and acceptance and less in rumination, on a daily basis, individuals experienced lower levels of anger. The relation between rumination and anger was the only one influenced by all moderators tested. These findings advance our understanding of anger regulation by suggesting that the interplay between regulatory strategies, perceived control, and motivational factors is crucial in shaping emotional experiences. They also highlight the necessity of tailoring anger management intervention to address not only the use of specific ER strategies but also the contextual and motivational features that shape their impact. For instance, enhancing individuals' sense of control may serve as a protective factor against the influence of rumination on increased anger. Also, helping individuals clarify their hedonic and instrumental motives may decrease the likelihood of engaging in counterproductive rumination that might intensify anger.

Building on the results of the meta-analysis and of the second study which showed that both habitual and momentary use of reappraisal and acceptance is negatively associated with anger, in the next

study we examined the effectiveness of reappraisal and acceptance in reducing anger, instructed in an online-based intervention that targeted individuals with high trait anger. Prior research has yielded mixed findings regarding the effectiveness of reappraisal in reducing anger. By conducting the third study, we aimed at bringing more clarity to the topic. We expected that reappraisal and acceptance would significantly reduce anger compared to simply acting neutrally, and that these results would persist on the one-month follow-up as well. Although there were significant reductions in both types of anger (i.e., trait anger and state anger) over time, there were no significant differences in the effect sizes between groups. Despite the null findings, this study contributes to the debate on the effectiveness of online-delivered interventions, by prompting improvements. For instance, providing engaging content, such as interactive exercises, explanatory videos and images. Additionally, providing multiple opportunities for interaction with a specialist may enhance treatment outcomes, given that the therapeutic alliance has been shown to account for nearly 30% of variance in patient improvement (de Felice et al., 2019).

Study 4 extended the work conducted up to this point in this research project by investigating expressive flexibility (EF) – a form of emotion regulation flexibility – in an angering context. Previous research showed that EF is associated with several psychopathology outcomes (e.g., Rodin et al., 2017), and suggested a potential involvement of EF in the well-established relation between childhood maltreatment and psychopathology (Pițur & Miu, 2020). We have contributed to the literature by examining EF in an anger-inducing social interaction (i.e., Anger-infused Ultimatum Game, AiUG) and as a mediator between childhood maltreatment and psychopathology. We found that the AiUG elicited anger more strongly than other emotions, particularly in response to unfair offers, and that acceptance behavior significantly decreased with unfairness increase. Higher levels of psychopathology and its increase over time were predicted by childhood maltreatment, but not by expressive flexibility in anger.

Overall, the findings of this thesis support the previous literature that underlies the role of emotion regulation in problematic anger and deepens the understanding of the direction and magnitude of the relations between anger and specific emotion regulation strategies. Moreover, this thesis advances the existing literature by capturing the relation between anger and the momentary use of emotion regulation in ecological settings, while indicating the role that perceived controllability over a situation and emotion regulation motives play in these relations. The findings of this thesis also suggest that complex and longer online-interventions may be needed to efficiently regulate anger. Another key contribution of this thesis is proposing a new starting point for research on how anger-related expressive flexibility is involved in the established relation between childhood maltreatment and psychopathology. This thesis also has several important contributions to clinical practice. This research project offers valuable insights for developing effective treatments targeting anger, encouraging the consideration of personal factors, and recommending more interaction in the online-delivered interventions.

4.2. Methodological Implications

This thesis also addresses several key methodological gaps in the literature of anger regulation. First, by employing a meta-analytical approach, it offers a more robust and comprehensive understanding of the associations between anger and specific emotion regulation strategies. This methodological advancement strengthens the validity of conclusions regarding these relations and provides a clearer foundation for future research. Another significant contribution of the meta-analysis is the identification of study-level differences that explain the heterogeneity in previous findings. Moreover, this work highlights methodological limitations in prior research, offering valuable insights into specific areas that require improvement to enhance the rigor and quality of future studies.

One limitation identified across the studies included in the meta-analysis was that overreliance on single retrospective assessments. To address this limitation, in our second study we used an ecological approach, namely Ecological Momentary Assessment (EMA), to account for both between- and within-individual variability in spontaneous anger regulation. In addition, conducting this daily diary design study also answered the urge, identified in the meta-analytical work, of conducting studies that allow for the examination of temporal dynamics between anger and emotion regulation strategies.

In the next study we conducted we aimed to overcome some of the limitations of previous studies which investigated the effectiveness of acceptance and reappraisal in reducing anger. These were the lack of a follow-up measure for longer than 1 day (e.g., Germain & Kangas, 2015) which could inform on the sustainability of an intervention, and the lack of a comparison with a control condition (in case of acceptance) which prevents any inference regarding the validity of the results. Another shortcoming of previous studies is the lack of practice included in the intervention being tested, which raises the risk of participants using the instructed strategies in a wrong way. In order to overcome these problems, we included an active-control group, a follow-up measure at 1-month and six practice sessions incorporated in the intervention. Also, we offered participants personalized feedback after each exercise in order to correct any errors in the use of the strategy.

Considering that dysfunctional anger is strongly associated with psychopathology, it is essential to develop robust ecological experimental paradigms that can evoke and measure anger. One proposal is the Anger-infused Ultimatum Game, a variant of the Ultimatum-Game (Güth et al., 1982) created by Gilam and colleagues (2019). A significant contribution of this study is offering empirical evidence that anger can be successfully induced in a laboratory setting that simulates a real-life social context (i.e., bargaining interaction). Another important contribution of this study is the integration of the expressive flexibility paradigm, developed by Bonanno and collaborators (2004), in the Anger-infused Ultimatum Game, allowing the investigation of expressive flexibility in the context of a social interaction.

4.3. Limitations and Future Directions

While the studies included in this thesis offer significant theoretical and clinical contributions, they are not without limitations. Beyond the specific constraints presented in the discussion section of each study, this section indicates broader limitations that apply to multiple studies within this thesis.

First, sample representativeness is limited considering that the samples were conducted on healthy participants, not on clinical populations. Moreover, the samples were predominantly composed of women. Future studies should extend these investigations to clinically diagnosed individuals to determine whether similar patterns hold. Addressing these limitations, future studies should also explore potential role of age- and sex-related differences in anger regulation.

Another limitation stems from the reliance on self-report measures across all studies, with the exception of Study 4 where external ratings were also included. Future research should integrate complementary assessment (e.g., clinician-rated instruments or physiological measures).

Another general limitation resides in the impossibility of drawing any firm conclusion regarding the effectiveness of emotion regulation strategies in reducing anger, considering that the experimental study on this topic included in the current thesis yielded null findings. We encourage future research to adopt an experimental approach with a rigorous and more extended protocol.

Despite these limitations, we believe that this thesis has important implications in the field of anger. Our findings show that anger is consistently associated with the differential use of emotion regulation strategies, highlighting that it is positively associated with rumination, and negatively with acceptance and reappraisal across situations, while perceived controllability, and hedonic and

instrumental motives play a significant role in these connections. This thesis also brings evidence for the hypothesis that dysfunctional regulation serves as a core mechanism underlying problematic anger.

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