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The Use of Emotion Regulation Strategies and the Related Neural Activation Patterns are Influenced by Culture

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School of Applied Psychology

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Publication-based thesis submitted for

the degree of PhD by Research

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Table of Contents

Declaration of Originality 5

List of Figures 6

List of Tables 7

Acknowledgements 8

Abstract 10

Chapter One: General Introduction 12

Cultural Views of Emotion Regulation 13

Difficulties in Cross-Cultural Research 21

Thesis Structure 24

Reference 27

Chapter Two: Differences and similarities in the use of nine emotion regulation strategies in Western and East-Asian cultures: A systematic review and meta-analysis 40

Abstract 40

Introduction 42

Method 47

Results 54

Discussion 64

Limitations 73

Conclusion 73

Reference 74

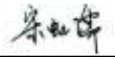
Chapter Three: A cross-cultural study of self-compassion and the moderating role of alexithymia 93

Abstract 93
Introduction 95
Methods 100
Results 104
Discussion 111
Limitations 120
Conclusion 122
References 123
Chapter Four: Neural activation patterns during self-compassion and cognitive reappraisal are influenced by culture: An electroencephalography (EEG) study 141
Abstract 141
Introduction 144
Methods 149
Results 157
Discussion 162
Limitations 167
Conclusion 168
References 169
Chapter Five: General Discussion 183
Key Findings and Contributions 183
Culture Shapes Emotion Regulatory Frequency 183
Behavioural Benefits Across Cultures 188
Neural Activation Patterns are Influenced by Culture 189
Exploring Emotion Regulation Based on Dynamic Culture 190

Methodological Improvements 191
Limitations 193
Future Directions 197
Conclusions 200
Reference 202
Appendix 1: Search strategies of databases in Chapter Two 212
Appendix 2: Characteristics, included countries, and risk of bias of eligible studies in Chapter Two 215
Appendix 3: The variation between studies in Chapter Two 220
Appendix 4: Results of the balanced sample for Chapter Three 221
Appendix 5: Informed consent sheet used in Chapter Three 224
Appendix 6: Informed consent sheet used in Chapter Four 230

Declaration of Originality

This is to certify that the work I am submitting is my own and has not been submitted for another degree, either at University College Cork or elsewhere. All external references and sources are clearly acknowledged and identified within the contents. I have read and understood the regulations of University College Cork concerning plagiarism and intellectual property.

Digital signature of the candidate: 

List of Figures

Figure 2.1: PRISMA 2020 Flow Diagram of the articles in the review

Figure 2.2: Overall effects of culture on the spontaneous use frequency of emotion regulation strategies

Figure 2.3: Publication bias for the effects of culture on the spontaneous use frequency of emotion regulation strategies

Figure 3.1: Descriptive statistic for the Self-Compassion Scale

Figure 3.2: Pearson's correlations between variables in Ireland and China

Figure 4.1: Visualization of example trials for self-compassion and cognitive reappraisal experimental sessions

Figure 4.2: Main effects of Country on PSD values across frequency bands

Figure 4.3: Effects of self-compassion on PSD values across frequency bands

Figure 4.4: Effects of cognitive reappraisal on PSD values across frequency bands

List of Tables

Table 2.1: Definitions of the nine emotion regulation strategies in the review

Table 3.1: Cultural mean differences, internal consistencies, cultural measurement equivalence, and Pearson's correlations by country.

Table 3.2: Multiple regression analyses (by country) examining the moderating effects of alexithymia on the relation between cultural values and self-compassion

Table 3.3: Multiple regression analyses (by country) examining the moderating effects of alexithymia on the relation between cultural values and self-coldness

Table 4.1: Mean negative emotions ratings and standard deviations

Table 4.2: Mean positive emotions ratings and standard deviations

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Abstract

Emotion regulation is a rapidly growing field in psychology, and culture has been shown to play a non-negligible role in emotion regulation processes. Despite the attention given to comparisons between Western countries and East-Asian countries in this field, some emotion regulation strategies remain understudied. Through a series of large cross-cultural empirical studies, this thesis aims to understand how culture (specifically Western culture vs. East-Asian culture) shapes emotion regulation in regard to strategy use frequency, behavioural consequences, and neural activation patterns.

As the first step, I conducted a systematic review and meta-analysis (Chapter Two) that synthesized cross-cultural comparison studies on the most common emotion regulation strategies studied to date. This synthesis of evidence 1) indicated greater spontaneous use of suppression and avoidance in East-Asian adults compared to Western adults, and no cultural difference in the use frequency of reappraisal, rumination, and expression; 2) identified research gaps in the cross-cultural investigation of four strategies (i.e., self-compassion, mindfulness, acceptance, and distraction) that need to be addressed in the future; 3) highlighted methodological inadequacies in the existing cross-cultural research. Following this synthesis of evidence, this thesis focused on the research gap of similarities and differences in self-compassion between Western individuals and East-Asian individuals, with adults from Ireland and China as comparison participants. Moreover, methodological inadequacies were addressed by measuring cultural values at the individual level, testing cultural measurement invariance, reporting the

ethnicity of participants clearly, and distinguishing between emotional valences. The results of the cross-sectional survey study presented in Chapter Three supported greater use of self-compassion and a more complex association between self-compassion and cultural values at the individual level in Chinese adults compared to Irish adults. Further, Chapter Four presents an electroencephalography (EEG) experimental study that explored self-compassion both at a behavioural and a neural level among Chinese and Irish university students, while comparing with cognitive reappraisal which is frequently promoted as an adaptive emotion regulation strategy. This experimental study found 1) self-compassion and cognitive reappraisal have efficacy across cultures in relieving negative emotions and promoting positive emotions; 2) neural activation patterns during the particular emotion regulation process differ across cultures, with greater frontal power during self-compassion in the Chinese sample but greater posterior power during cognitive reappraisal in the Irish sample.

In summary, this thesis as a whole supports the universal behavioural benefits of self-compassion across cultural groups, whereas there are differences in the use frequency and neural activation patterns between the Chinese and Irish samples. This thesis contributes to the understanding of how culture shapes emotion regulation through both primary empirical studies and the synthesis of available literature.

Chapter One: General Introduction

In an increasingly stressful world, it is crucial to help individuals regulate their emotions to relieve emotional distress such as depression, anxiety, and stress. Thus, emotion regulation strategies have become an increasing part of public discourse in addressing mental health difficulties. It cannot be ignored that how a person regulates emotions may vary depending on their cultural context. In psychological research, however, it is the population living in Western, Educated, Industrialized, Rich, and Democratic societies that makes up the majority of research samples (Apicella et al., 2020; Henrich et al., 2010; Roberts et al., 2020). Henrich et al. (2010) found that Western, Educated, Industrialised, Rich and Democratic people make up over 80% of study participants in behavioural science, but only 12% of the global population. Despite efforts by researchers to address this issue in the past decade, the lack of cultural diversity in the research samples has not changed much (Apicella et al., 2020). This raises a question: Are the accepted ideas about the existing emotion regulation strategies universally applicable across cultural groups? This thesis seeks to answer this question by focusing on the comparison between Western individuals and East-Asian individuals, since these two cultural groups have dominated the literature on emotion regulation and culture (Ford & Mauss, 2015). Western individuals are those whose country of residence and ethnicity are both Western countries, and East-Asian individuals are those whose country of residence and ethnicity are both East-Asian countries (see Chapter Two for specific Western countries and East-Asian countries). In this chapter, I will introduce the cultural views of emotion regulation over the past decades, along with

possible difficulties in conducting cross-cultural research, followed by the overall structure of this thesis.

Cultural Views of Emotion Regulation

Emotion regulation involves a series of processes during which individuals modify their emotional experiences and expressions (Gross, 2015). In psychological research, emotion regulation has been taken as an important topic and developed rapidly over the past decades. Building on a number of research areas that examined different forms of emotion regulation strategy, a process model of emotion regulation was proposed by Gross (1998, 2015) to include multiple emotion regulation strategies in a conceptual framework. Existing research has examined the frequency and consequences of using these emotion regulation strategies, mainly in Western populations (Joormann & Stanton, 2016). Nonetheless, empirical cross-cultural studies have been steadily increasing in response to the concerns raised by Henrich et al. (2010) that the overreliance on Western samples might pose a risk to the understanding of human behaviours. It is a promising sign that cross-cultural comparisons have yielded some new insights (Ford & Mauss, 2015; Matsumoto & Juang, 2007; Song et al., 2024). Therefore, this thesis began with the idea of synthesizing how culture shapes the use of particular emotion regulation strategies and further identifying research gaps to inform future empirical research in cross-cultural exploration.

Recently in psychology, culture has been defined as a dynamic yet relatively stable system of attitudes, values, beliefs, norms, and behaviours that emerge within groups and are typically transmitted across generations (Matsumoto & Juang, 2007).

Culture affects how a person engages in the emotion regulation processes and whether the use of a particular emotion regulation strategy is adaptive or maladaptive. Comparisons between Western individuals and East-Asian individuals have received much attention in the field of emotion regulation and culture. In the popular model of culture proposed by Hofstede et al. (2010), *individualism and collectivism* have been widely studied in the comparisons of Western and East-Asian culture. Individualistic cultures (such as Ireland) expect people to be independent, and prioritize the "personal self" and individual goals; whereas collectivistic cultures (such as China) encourage people to be interdependent, emphasize the link between the self and others, and prioritize group goals and interpersonal relationships (Ford & Mauss, 2015; Kitayama et al., 1997; Markus & Kitayama, 1991; Matsumoto & Juang, 2007). In the context of emotion regulation, another dimension in the cultural model of Hofstede et al. (2010) named *long/short--term orientation* has also been suggested to play an important role in understanding the differences between Western individuals and East-Asian individuals. Specifically, individuals in the cultures that value short-term orientation (such as Ireland) are more likely to prefer strategies that are immediately effective for emotional relief, whereas those in the cultures that value long-term orientation (such as China) tend to consider future consequences when regulating current emotions (Montero-Marin et al., 2018; Nisbett et al., 2001).

Culture practices may influence how frequently and how culturally adaptive individuals are in using a particular emotion regulation strategy. Briefly, an emotion regulation strategy that matches expectations in a specific socio-cultural context is

more likely to be used by individuals, since it is socially encouraged and rewarded (Butler et al., 2007; Ford & Mauss, 2015; Markus & Kitayama, 1991; Mesquita, 2001). For instance, suppression which inhibits outward emotional expression, appears to be the most frequently studied emotion regulation strategy when comparing Western individuals and East-Asian individuals. This has been reflected in the systematic review and meta-analysis in the next chapter (Chapter Two), indicating greater suppression usage in East-Asians compared to Westerners. Such differences might be influenced by culture-specific consequences associated with suppression. People in East Asian collectivistic cultures tend to control their emotions to match the emotions of the group or society in order to maintain group harmony. Instead, people in Western individualistic cultures are less likely to use suppression, as such behaviours contradict the pursuit of personal authentic emotions, encouraged in their cultural contexts, which may result in poor mental health and increased hostility in social interactions (Butler et al., 2007). Previous experimental studies found a significant positive correlation between suppression usage and depressed mood among European-Americans, whereas suppression usage and depressed mood were not correlated among East-Asians (Soto et al., 2011). This highlights the importance of understanding emotion regulation strategies within their cultural context. Therefore, despite an accepted idea, mainly based on Western data, that suppression results in maladaptive consequences, it may result in fewer interpersonal and emotional costs for East-Asians and may even improve group harmony, potentially leading to more use of suppression in East-Asians. Therefore, emotion regulation strategies may have divergent behavioural consequences across

cultures, which further affect how frequently people use a particular strategy.

Moreover, an increasing number of studies using EEG and fMRI have explored how culture shapes neural processes of emotion regulation (see reviews, Hampton & Varnum, 2018; Han & Ma, 2014). Cultural differences and similarities of neural activation patterns during emotion regulation may not always match behavioural outcomes. For example, previous studies found that there was no difference in late positive potential (LPP) responses between Westerners and East-Asians, despite East-Asians reporting using more suppression at the behavioural level (Hampton et al., 2021; Varnum & Hampton, 2017). In addition, despite the cross-cultural benefits of some emotion regulation strategies, different cultural groups may engage in the regulatory processes of the particular strategy in different ways, resulting in diverse neural activation patterns (Knyazev et al., 2012; Qu & Telzer, 2017). Given the lack of cross-cultural comparison research on neural activation patterns during emotion regulation, one key aim of this thesis is to provide cross-cultural electrophysiological evidence to advance the understanding of the neuro-culture interactions.

Furthermore, some evidence have supported the argument that emotion regulation is impaired by alexithymia, which is defined as difficulties with emotional awareness (Panayiotou et al., 2019; Preece et al., 2023). Based on clinical observations, psychoanalysts suggested that insecure attachment experiences in infancy and early childhood (e.g., caused by emotional neglect) contribute to the aetiology of alexithymia (McDougall, 2010; Ruesch, 1948). Moreover, trauma researchers noticed concentration camp survivors who were emotionally healthy

before their confinement in concentration camps, but developed alexithymia , thus suggesting that alexithymia can also be caused by catastrophic traumatic events in adolescence or adulthood (Krystal, 1979, 2015). Although cross-cultural explorations toward alexithymia are rare, some studies suggested that East-Asians self-reported higher levels of alexithymia compared to Westerners (Dere et al., 2012; Lo, 2014). The discussion about culture influences mainly surrounding one component of alexithymia - externally oriented thinking (EOT) that emphasizes more external stimuli than internal emotional experience (Bagby et al., 1994). Alexithymia, which has been treated as an emotional deficit, is rooted in Western cultural values and norms of emotional experience and expression (Aival-Naveh et al., 2019; Kirmayer, 1987). However, in the East-Asian cultural context that encourages individuals to pay attention to external environment for maintaining group harmony, EOT maybe just a way that people perceive emotions in daily life to healthily adhere to cultural values and norms (Le et al., 2002; Lo, 2014; Ryder et al., 2018). Therefore, greater EOT may be the driver of higher levels of alexithymia in East Asians, whilst being unrelated to emotion processing difficulties. Previous studies suggested that individuals high in alexithymia are less likely to use cognitive reappraisal and more likely to use suppression and avoidance (Preece et al., 2018; Preece et al., 2023; Stasiewicz et al., 2012; Swart et al., 2009). In addition, they are less likely to proactively solve problems and seek social support (Aldao et al., 2010; Preece et al., 2023). According to the attention-appraisal model of alexithymia (Preece et al., 2017), those high in alexithymia may not know what emotions they are experiencing and how to regulate them appropriately. When it comes to emotion

regulation, it is important to employ appropriate strategies according to the situation, but alexithymia impairs the ability to evaluate and attend to emotions, leading to insufficient information for subsequent emotion regulation decisions (Aldao et al., 2015; Sheppes et al., 2011). To the best of my knowledge, no previous studies that have directly investigated how culture influences the relationship between alexithymia and emotion regulation strategies. Nevertheless, it is possible that the self-focus and personal emotional need emphasized by individualism can weaken the impairment of alexithymia to emotion regulation, as it can redirect attention back to the self and promoting emotional awareness, thereby employing less avoidant-type emotion regulation strategies (Brewer et al., 2016; Coriale et al., 2012; Panayiotou et al., 2015). Therefore, alexithymia may be culturally sensitive, and cultural values and norms surrounding emotions may affect the ability to identify and describe emotions and regulate them appropriately (Aival-Naveh et al., 2019; Le et al., 2002; Ryder et al., 2018).

Following the research gaps identified by the systematic review and meta-analysis presented in Chapter Two, this PhD thesis further explores self-compassion across cultures in both a cross-sectional survey study (Chapter Three) and an EEG & behavioural experimental study (Chapter Four). Self-compassion refers to accepting one's own suffering, being kind and supportive towards oneself, while also viewing suffering as an experience that happens to others as well (Neff, 2003). While self-compassion originated in the traditions of Eastern Buddhism, it was first conceptualized and developed in the West (Neff, 2003; Neff et al., 2008). It has been suggested that the levels of self-compassion may be partially shaped by culture

(Montero-Marin et al., 2018). For example, self-compassion is based on the attitude towards the "self" that is the core of the widely studied cultural values of individualism and collectivism (Heine, 2003; Kitayama et al., 2022; Markus & Kitayama, 1991; Neff, 2003). Compared to individualistic cultures, collectivistic cultures tend to emphasize group harmony which matches the interconnectedness in the concept of self-compassion and may lead to greater use frequency of this strategy in everyday life (Ford & Mauss, 2015; Kitayama et al., 1997; Markus & Kitayama, 1991; Matsumoto & Juang, 2007). Individualism may motivate competition and isolated interpersonal relationships, leading to the relative absence of self-compassion (Montero-Marin et al., 2018; Steindl et al., 2020). Montero-Marin and his colleagues (2018) also found a significant positive correlation between long-term orientation and self-compassion. Compared to short-term orientation, long-term orientation encourages a more positive mindset and behaviours to prepare for the future, thus fostering self-compassion (Hofstede, 2023; Hofstede et al., 2010; Montero-Marin et al., 2018). Additionally, since self-compassion was introducing to the West as a new form of emotion regulation, previous qualitative research explored the reactions to the concept of self-compassion with the British sample (Campion & Glover, 2017). In this study, participants expressed that giving compassion to themselves created a feeling of vulnerability, and this seemed to be influenced by the expectations in the Western society such as personal achievement and competition. Thus, the lack of social acceptance might bring challenges in using self-compassion among Westerners.

There is growing evidence that self-compassion is associated with various

benefits such as greater psychological health and well-being (Egan et al., 2022; Trindade & Sirois, 2021; Zessin et al., 2015), despite the majority of research being cross-sectional and therefore unable to infer causality. Furthermore, some researchers have found that self-compassion can help relieve emotional distress including negative emotions, depression, and anxiety (Ferrari et al., 2019; Kirby et al., 2017). However, it cannot be concluded that this emotion regulation strategy is universally applicable, as most of these studies were conducted in Western cultural contexts, with very few conducted in East-Asian cultural contexts (Kariyawasam et al., 2023). To further investigate the extent to which self-compassion is effective, cognitive reappraisal which is frequently promoted as an adaptive emotion regulation strategy cross-culturally was taken as a comparison in the experimental study in Chapter Four. Cognitive reappraisal is defined as thinking about negative situations from another perspective to help people feel better (Gross & John, 2003). The systematic review and meta-analysis in Chapter Two indicated that the use frequency of cognitive reappraisal has been sufficiently examined in cross-cultural comparison studies and cultural differences have not been observed between Western and East-Asian individuals. Additionally, cognitive reappraisal has been demonstrated to be beneficial across cultural groups in reducing negative emotions and anxiety, and increasing positive emotions and life satisfaction (Blalock et al., 2016; Silvers et al., 2015; Troy et al., 2019).

I move forward to explore how culture shapes neural activation patterns during emotion regulation processes in Chapter Four. In the process model of emotion regulation, both self-compassion and cognitive reappraisal are cognitive

regulatory strategies that belong to the Cognitive Change stage (Gross, 1998, 2015). Brain activation patterns during these two cognitive regulatory strategies have been explored in both EEG and fMRI studies. Regarding self-compassion, due to its nature as a complex cognitive regulatory process involving multiple parts (mindfulness, common humanity, and self-kindness), gamma oscillation has been suggested to play an important role, as this band has been linked with the processing of complicated information, particularly in the frontal and parietal cortices (Berry et al., 2020; Guan et al., 2021; Kim et al., 2020; Luo et al., 2023; Lutz et al., 2004). During cognitive reappraisal, there is evidence for the engagement of prefrontal and parietal regions across frequency bands (Buhle et al., 2014; Gross, 2015; Morawetz et al., 2017; Ochsner et al., 2012; Ochsner & Gross, 2005). From the perspective of cultural neuroscience, although there is increasing evidence for the benefits of these two cognitive regulatory strategies, one cultural group may engage in the regulatory process differently compared to another cultural group, resulting in different neural activation patterns (Knyazev et al., 2012; Qu & Telzer, 2017). Given the most widely recognized cultural difference that more "personal self" is valued in the West compared to East-Asia, it is possible to observe greater levels of activation in the posterior brain regions in Westerners compared to East-Asians, since these regions are often regarded as a hub of the processing of self-related information (Knyazev, 2013; Northoff, 2016; Northoff et al., 2006).

Difficulties in Cross-Cultural Research

As a reminder for future research, some specific difficulties in cross-cultural investigations are noteworthy. Firstly, it is challenging to synthesize cross-cultural

comparative evidence comprehensively due to a number of existing studies failing to provide culture-relevant information about participants. Rad et al. (2018) showed that approximately 11% of psychological studies that were published in the year 2014 did not provide any culture-relevant information on the sampled populations, and these researchers assumed, at least implicitly, that their interpretations could be generalized to "generic humans". In the systematic review and meta-analysis outlined in Chapter Two, I had to exclude studies that did not clearly report the ethnicity of participants, limiting a more comprehensive synthesis comparing diverse populations. In addition, a dichotomous distinction between the West vs. the East was routinely taken as a tendency to suggest that Western cultures are individualistic and Eastern cultures are collectivistic, leading to narrow interpretations of cultural differences. This dichotomous distinction, which persists to this day, neglects the dynamic nature of culture. In Chapter Three of this thesis, I sought to address this issue by collecting the country of residence as well as measuring the endorsed cultural values of each participant.

Secondly, in cross-cultural comparative studies that rely on self-report questionnaires, one challenge is to confirm whether the measurement properties of these questionnaires are the same across sampled cultural groups, which is the prerequisite for inferring differences across cultures. In other words, the observation of cultural differences is convincing only when the measurements target the same construct, that is, the comparability has been confirmed. Otherwise, the conclusions are not valid if we are comparing apples to oranges. Cross-cultural comparative research is becoming increasingly popular in psychology. Surprisingly, cultural

measurement equivalence testing is rarely employed in cross-cultural investigations, despite multiple approaches which have been developed for equivalence testing. This neglect is also reflected in the synthesis of evidence in Chapter Two. Thus, in the survey study outlined in Chapter Three, I added cultural measurement equivalence testing as part of the methods section before the formal analysis. Apart from cultural measurement equivalence, there are other comparability concerns in cultural comparative research, such as the quality of translation of the questionnaires into another language, and divergent response styles across cultural groups (e.g., people from a particular culture are more likely to choose the midpoint of a scale more often than those from other cultures). These potential methodological issues also need to be considered when interpreting results observed in cross-cultural survey studies.

Finally, cross-cultural empirical comparisons of brain mechanisms (e.g., using EEG and fMRI) are exciting, yet challenging. For such experiments to proceed smoothly, certain prerequisites must be met, including but not limited to international collaborative networks of researchers, access to equipment based on the same system in all countries where data is collected, the same quality of experimental control across laboratories. Due to these requirements, cross-cultural comparative EEG and fMRI experiments are very difficult to conduct, resulting in very few studies in the literature. Despite many cultural neuroscience studies comparing Westerners with migrants (e.g., East-Asians living in Western countries) based on simple sampling, it is questionable whether these insights can be applied to native populations, since they ignore the influence of cultural exposure. In the cross-

cultural EEG study outlined in Chapter Four, I sought to address all the concerns raised above by collaborating with a Chinese laboratory and traveling to China for recruitment and data collection.

Despite these difficulties in cross-cultural research, it is necessary to explore cultural diversity in human psychology. There are no "standard participants" that can represent all humans. This PhD project as a whole sought to break through these limitations and provide more in-depth cultural insights into psychological research.

Thesis Structure

As introduced previously, the potential impacts of culture on emotion regulation involve frequency of emotion regulation strategy usage, behavioural consequences, and physiological mechanisms. This thesis aims to provide further evidence for all these aspects by conducting three large cross-cultural empirical studies that focus on comparisons between Western and East-Asian cultures.

This thesis consists of a series of papers written for academic journals as well as conference presentations. One of these papers has been published, while two others have been pre-printed and are currently under review. Two of these studies have been presented at academic conferences. A brief overview of each chapter has been introduced below.

Chapter Two presents the paper 'Differences and similarities in the use of nine emotion regulation strategies in Western and East-Asian cultures: A systematic review and meta-analysis' (Song et al., 2024). With the increasing cross-cultural comparative studies (Western individuals vs. East Asian individuals) in the field of emotion regulation, Chapter Two reviews the most extensive emotion regulation

strategies studied to date to explore how culture impacts spontaneous frequency of these strategies usage. This review highlights potential cultural differences and similarities of using these strategies, as well as identifying several research gaps in the current cross-cultural literature (e.g., lack of focus on some emotion regulation strategies, methodology inadequacies). Additionally, the data and detailed *R* code of this paper have been made publicly available so that future studies can benefit from a clear and rigorous analytic framework. This paper has been published in the *Journal of Cross-Cultural Psychology*.

Chapter Three builds on a research gap identified by the systematic review and meta-analysis that self-compassion is understudied. This is a cross-sectional survey study aimed at comparing Irish and Chinese adults in terms of self-compassion use frequency, investigating how self-compassion associates with cultural values at the individual level, and exploring whether these relationships would be moderated by alexithymia. This study measures cultural values at the individual level rather than relying on a dichotomous distinction at the national level, which allows us to provide empirical evidence for culture's dynamic nature. To our knowledge, this is the first study exploring the moderating role of alexithymia between cultural values and self-compassion, offering preliminary evidence to this field. This work is under review by an academic journal.

Chapter Four moves towards the comparison between Irish and Chinese university students on self-compassion intervention in terms of behavioural effectiveness and neural activation patterns through an EEG experimental study. To further investigate the extent to which self-compassion is effective, I compared it

with cognitive reappraisal, which is frequently promoted as an adaptive emotion regulation strategy. This is an ambitious study in collaboration with a university in China (Shaanxi Normal University). As the experimenter of this cross-cultural EEG study, after conducting the experiments in Ireland, I traveled to China for recruitment and data collection of the Chinese sample, ensuring experimental control quality across laboratories. This EEG study provides convincing cross-cultural empirical evidence for the field of cultural neuroscience by comparing neural activation patterns across cultural groups in a single study. This work is under review by an academic journal.

Finally, in Chapter Five, key findings and contributions of this thesis are described regarding cross-cultural use frequency of emotion regulation strategies and effectiveness of emotion regulation interventions, as well as neural activation patterns during emotion regulation processes. Further, I call for the consideration of culture's dynamic nature and the improvement of methodology in cross-cultural investigations. The limitations of this thesis and suggestions for future directions are also discussed in this chapter.

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Chapter Two: Differences and similarities in the use of nine emotion regulation strategies in Western and East-Asian cultures: A systematic review and meta-analysis

Abstract

Differences in emotion regulation strategies usage between Western and East-Asian individuals have been shown to exist. In this systematic review and meta-analysis, we aimed to synthesize differences and similarities of the spontaneous use frequency of nine emotion regulation strategies (suppression, reappraisal, acceptance, avoidance, rumination, mindfulness, distraction, expression, and self-compassion), in Western and East-Asian individuals. Quantitative comparison studies were identified through systematic and snowball searches. Meta-analysis was undertaken with the meta package from *R*. Nineteen articles involving 21 studies were included in the systematic review and 20 studies were included in the meta-analysis. These articles were published from 2002 to 2023. The results showed that East-Asian individuals use more suppression ($d = -0.29$) and avoidance ($d = -0.57$) compared with Western individuals, with a medium effect size. No significant difference was observed in reappraisal, rumination, and expression usage. Future comparison studies across Western and East-Asian cultures should consider focusing on the use of self-compassion, acceptance, distraction, and mindfulness, which are understudied in the field of emotion regulation. Moreover, to improve the methodology, address inadequacies in analyzing cultural measurement invariance, distinguishing between emotional valences, and reporting participants' ethnicity.

Keywords: emotion regulation strategy, culture, systematic review, meta-analysis

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Hongru Song: Conceptualisation, Methodology, Systematic and snowball searches, Data selection, Data extraction and coding, *R* code programming, Data analysis, Synthesis, Interpretation, Writing - original draft, revision, and editing.

Dr. Jason Chan: Supervision, Conceptualisation, Methodology, Validation and reliability checks, Writing - review, commentary, and editing.

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Introduction

Emotion regulation refers to all the processes that modify which emotions we have, when we have them, and how we experience or express these emotions (Gross, 2015). One commonly used framework for studying emotion regulation strategies is the process model of emotion regulation (Gross, 1998). The model predicts that the use of emotion regulation strategies will have different consequences for how a person feels, thinks, and acts, both immediate and long term (Gross, 2015; Quoidbach et al., 2015). Nine emotion regulation strategies that are frequently studied within this framework are suppression, reappraisal, acceptance, avoidance, rumination, mindfulness, distraction, expression, and self-compassion (Table 2.1). These strategies have a substantial body of research supporting their definitions and use in emotion regulation. In the present systematic review and meta-analysis, we synthesized differences and similarities of the spontaneous use frequency of these nine emotion regulation strategies in Western and East-Asian cultures.

Table 2.1

Definitions of the nine emotion regulation strategies in the review

Emotion Regulation Strategy	Definition
Suppression	The inhibition of outward emotional expression (Gross & John, 2003).
Reappraisal	Either cognitive revaluating of the emotion eliciting situation or changing the self-relevance of an emotional situation (Gross & John, 2003).
Acceptance	Acknowledging distressing emotions, without trying to suppress, control, avoid, change, or judge them (Hayes et al., 1996).
Avoidance	Trying not to accept and experience distressing thoughts, feelings, memories, and other internal

	events (Hayes et al., 1996).
Rumination	Repeatedly focusing on causes and consequences of negative emotional stimuli (McRae & Gross, 2020).
Mindfulness	Receptive attention to and awareness of present events and experience (Brown & Ryan, 2003).
Distraction	Directing attention away from emotional stimuli to decrease their emotional impact (McRae & Gross, 2020).
Self-compassion	An attitude of kindness and acceptance towards difficult experiences and negative aspects of oneself (Neff, 2003).
Expression	Conveying emotional states by means of verbal or nonverbal modalities (Kennedy-Moore & Watson, 2001).

Emotion Regulation Strategies in Western and East-Asian Cultures

Decades of research explored the use frequency and effectiveness of different emotion regulation strategies (Joormann & Stanton, 2016). Although existing research has mainly been conducted with Western samples, some studies have documented similarities and/or differences among participants from other cultures in the use of these strategies. In the present systematic review and meta-analysis, we focus on the comparison between East-Asian and Western individuals because it has dominated the literature on emotion regulation, cross-culturally (Ford & Mauss, 2015; Hampton & Varnum, 2018). For the present study, we followed the suggestion of Matsumoto and Juang (2007) to define culture as a dynamic yet relatively stable system of attitudes, values, beliefs, norms, and behaviours that emerge within groups and are typically transmitted across generations. In addition, as another concept for being a part of the inclusion/exclusion criteria in the present study, ethnicity was defined as sharing a common descent and national or cultural

tradition according to the Oxford English Dictionary (2023). In all included studies of the present work, ethnicity was determined through self-report.

Existing evidence suggests that East-Asian and Western individuals may differ in their individualism/collectivism orientations, which may be associated with their emotion regulation choice (Butler et al., 2007; Cheung & Park, 2010; Ford & Mauss, 2015; Hofstede et al., 2010; Matsumoto et al., 2008). Western Individuals with individualistic orientations are expected to be independent and demonstrate the values of individuality, uniqueness, autonomy, and self-expression; whereas East-Asian individuals with collectivistic orientations are encouraged to be interdependent and demonstrate the values self-effacement and self-criticism, and they tend to connect themselves to others and prioritize their interpersonal relationships (Kim & Sherman, 2007; Markus & Kitayama, 1991). The emotion regulation strategy that is adaptive under a particular cultural context might be used more frequently because it is encouraged and rewarded, whereas an emotion regulation strategy under the same cultural context would be used less because it is socially discouraged. For example, previous research indicated that East-Asian individuals tend to use fewer emotional expressions than Western individuals (Kang et al., 2003). This difference may exist because of the inhibitory "display rules" (Ekman & Friesen, 1969) encouraged by East-Asian culture and not because East-Asians experience less emotion than Westerners (Mesquita & Frijda, 1992).

Differences and similarities in the spontaneous use frequency of specific emotion regulation strategies in Western and East-Asian individuals have been observed in previous studies. East-Asian individuals are more likely to use

suppression (Gross & John, 2003; Han et al., 2022; Matsumoto, 2006; Nozaki, 2018; Orkibi et al., 2021; Schunk et al., 2021, 2023; Soto et al., 2011; Su et al., 2014; Zhou et al., 2022), avoidance (Nishiguchi et al., 2022; O'Connor & Shimizu, 2002; Su et al., 2014) compared with Western individuals. However, Germans are more likely to use acceptance, compared with Japanese people (Schunk et al., 2022). Moreover, Chinese individuals reported using more mindfulness than European Americans (Kahn et al., 2017; Rich et al., 2022). The research from Rich et al. (2022) also suggested that Chinese individuals are more likely to use self-compassion than European Americans. East-Asians are less likely to use expression compared with Westerners (Kahn et al., 2017; Kang et al., 2003; Wei et al., 2013); although there is a study suggesting East-Asians use more expression than Westerners for negative emotions (Krys et al., 2022). According to a study by Schunk et al. (2022), Japanese use more distraction than Germans when facing positive emotions, but they are similar when distracting from negative emotions. There are inconsistent findings in the use of reappraisal and rumination. Some research did not find significant cultural differences in the frequency of using reappraisal between East-Asians and Westerners (Matsumoto, 2006; Schunk et al., 2021, 2022; Soto et al., 2011), whereas inconsistent results emerged that East-Asians are less likely (Nozaki, 2018) or more likely (Matsumoto, 2006; O'Connor & Shimizu, 2002) to use reappraisal compared with Westerners. East-Asians reported more rumination usage than Westerners, in some studies (Maxwell et al., 2005; Schunk et al., 2022), but less than Westerners in the study from Schunk et al. (2021).

Once the process of emotion regulation is underway, one's cultural context may influence the adaptiveness of using a specific emotion regulation strategy based on its consistency with society specific expectations. For instance, suppression might be an adaptive emotion regulation strategy in East-Asian culture because it is consistent with the values of interdependence and relationship harmony, which is to avoid direct confrontations, and thus be beneficial for preserving relationships; whereas suppression might be a socially discouraged emotion regulation strategy in Western culture because it conflicts with the high value placed on self-expression, seen as characteristic of authenticity, and thus lead to more perceptions of hostility and social withdrawal in interpersonal relationships (Butler et al., 2007).

The Current Systematic Review and Meta-Analysis

Currently, comparisons between Western and East-Asian individuals have dominated the literature on emotion regulation and culture. However, a comprehensive review of the effects of culture on the spontaneous use frequency of specific emotion regulation strategies is necessary to estimate the presence and strength of the effects, particularly given the sometimes-contradictory trends between studies.

A recent systematic review reported on cultural differences in the use frequency of emotion regulation strategies (Weiss et al., 2022). However, it focused on the comparison of ethnic majorities to ethnic minorities in a single country: they compared Westerners and migrants who are living in the same country. To avoid the overlap of the comparison objects and to reduce the influence of cultural exposure, the present study has clear criteria for both participants' ethnicity and country of

residence. Specifically, the present systematic review only focuses on the comparison between Westerners, whose country of residence and ethnicity are both Western and East-Asians, whose country of residence and ethnicity are both East-Asian. In addition, there is a meta-analysis involving a broad range of emotion regulation strategies to examine how different emotion regulation strategies are structurally related to one another (see Naragon-Gainey et al., 2017), but it did not examine the use frequency of these strategies or consider their cultural influences.

The present work moves beyond previous reviews, and includes the most extensive emotion regulation search strategy, considering the potential influences of culture and minimizing the influence of cultural exposure. Specifically, we aimed to identify research gaps in comparison studies across Western and East-Asian cultures on nine common emotion regulation strategies (suppression, reappraisal, acceptance, avoidance, rumination, mindfulness, distraction, expression, and self-compassion) and then synthesized the similarities and differences of spontaneously using these strategies in Western and East-Asian cultures.

Method

Information Sources

Systematic searches were conducted on PsycINFO, Web of Science, PubMed, and Scopus. Gray literature was searched in ProQuest Dissertations and Theses Global. These electronic databases were searched for studies published from their inception until December 16, 2023. Furthermore, snowball searching was conducted by searching the reference list of relevant studies to identify additional publications not captured by the computerized search. The authors of relevant

studies were contacted for any missing information (e.g., ethnicity of participants or means and standard deviations of the results).

Search Strategy

The following search terms which were used to capture three concepts, namely: emotion regulation, emotion regulation strategy, and cross-culture, along with the appropriate Boolean operators: ("emotion regulat*" OR "emotional regulat*" OR "affect regulat*" OR "affective regulat*" OR "emotion dysregulat*" OR "emotional dysregulat*" OR "affect dysregulat*" OR "affective dysregulat*") AND (suppression OR reappraisal OR acceptance OR avoidance OR rumination OR mindfulness OR distraction OR express* OR "self-compassion" OR strateg*) AND ("different cultur*" OR "cross cultur*" OR "across cultur*" OR "cultural variation*" OR "cultural difference*" OR "culturally different" OR "culturally diverse" OR "cross ethnic" OR "ethnic difference*" OR "racial difference*" OR "cross national*" OR "national difference*" OR "cultural context*" OR "cultural background*" OR "cultural norm*" OR "cultural value*" OR "cultural orientation" OR "cultural dimension*" OR "cultural group*" OR "culturally relevant" OR "cultural perspective" OR "culture specific" OR "cultural specificity" OR international OR multinational OR transcultur* OR multicultur*). For PsycINFO and Scopus, the search terms (including Index terms in PsycINFO) were entered into the title, abstract, and keyword fields; for Web of Science, the terms were entered into the topic field; for PubMed, the terms (including Mesh terms), were entered into the title and abstract fields; for ProQuest Dissertations & Theses Global, the terms were entered into the abstract field. Only “Language: English” was applied as a filter in

the database searches, with no restrictions based on the year of publication. The search strategy of databases is shown in Appendix 1.

Inclusion and Exclusion Criteria

Studies were included if they met the following criteria: (a) quantitative studies that have an English language version; (b) studies comparing Westerners and East-Asian samples. These are defined as Western samples are those whose country of residence and ethnicity are both Western (the United States, Canada, Australia, New Zealand, and countries in Europe) but not "ex-Communist" countries (such as Poland, Croatia, and the Czech Republic), as Inglehart (2006) has pointed out, these countries differ significantly on a range of cultural variables from the rest of Europe. East-Asians samples are those whose country of residence and ethnicity are both East-Asian countries and regions (China, Taiwan, Hong Kong, Macau, Japan, South Korea, North Korea, and Mongolia). Furthermore, we noticed that ethnic diversity has been brought about by globalization, especially in Western countries, we therefore applied relatively strict inclusion criteria for the ethnicity in the target countries to minimize the impact of ethnic diversity to ensure cultural homogeneity. Specifically, we only included studies that reported at least 80% of the sample shared the ethnicity that we focus on to ensure relatively low ethnic diversity in each sample (e.g., reported 80% European American in the U.S. sample); (c) studies examining either of suppression, reappraisal, acceptance, avoidance, rumination, mindfulness, distraction, expression, and self-compassion as an explicit emotion regulation strategy, and also described means, standard deviations, and sample sizes for the emotion regulation strategy; and (d) studies that only include adults aged 18

and over as participants. Meta-analysis was conducted when three or more studies contained the same emotion regulation strategy.

Studies were excluded if they: (a) manipulated emotion regulation strategies (experimentally or therapeutically) rather than measuring the spontaneous use of them; (b) compared Westerners and East-Asians who live in a single country; and (c) were qualitative studies, reviews, book chapters, meta-analyses, study protocols, and conference abstracts. We excluded one study focused on migraine patients because their spontaneous use of emotion regulation strategies may be more affected by headache symptoms and therapy, than culture (Wolf et al., 2020). We also excluded one study that focused on psychotherapists because they may adjust their emotions to achieve therapeutic goals, even though their use of emotion regulation strategies is often spontaneous (Chui & Liu, 2021). In addition, given that measurement invariance is a condition for conducting meaningful group comparisons, we excluded three studies in which measurement invariance was not observed in the compared cultural groups (Burghart et al., 2023; Hao et al., 2019; Tamir et al., 2024).

Study Selection

Duplicates were removed using the Mendeley software. Then, studies were selected via a two-step process. The first step involved screening the titles and abstracts in terms of the eligibility criteria. The second step involved reviewing the full texts of the articles identified in the first step to decide on which papers would be included in the final review. Two reviewers independently assessed whether the studies were eligible for inclusion in both steps. Consensus in both steps was

reached between two of the authors. The inter-reliability ratings in both stages were determined using the Prevalence and Bias-Adjusted Kappa (*PABAK;* Byrt et al., 1993). At the title and abstract stage, the inter-rater reliability was excellent (*PABAK* = 0.9487). For the full-text stage, the rate of reliability was 100%.

Risk of Bias in Individual Studies

The risk of bias in the included studies was assessed with the Crowe Critical Appraisal Tool, version 1.4 (Crowe, 2013). This tool consists of eight categories, including: (a) preliminaries, (b) introduction, (c) research design, (d) sampling, (e) ethical matters, (f) data collection, (g) results, and (h) discussion. Each category was scored from 0 = no evidence to 5 = highest evidence and summed to provide a total article score that was presented as a percentage. Based on criteria from a previous study (Sznitman & Taubman, 2016), the total score for each study was considered as "high quality" (if $\geqslant$ 75%), "moderate quality" (if 51%-74%), and "poor quality" (if $\leqslant$ 50%). Scoring was undertaken by the first author and cross-checked by the other authors.

Data Extraction

The required information was extracted and compiled into tables by the first author and checked by the remaining authors. Three authors of relevant studies were contacted for means and standard deviations of the results, with two responding. Another three authors were contacted for the ethnicity of participants but did not respond, so that, they were not included in the systematic review.

Information extracted from each study included:

1. *Demographics of participants.* Ethnicity, sample size, age (if specified), and percentage of female participants (if specified).

2. *Emotion variables.* Valence of emotion (if specified), emotion regulation strategy and measurement used, means, and standard deviations of the use frequency of emotion regulation strategies.

3. *Cultural measurement invariance.* Method and results (if tested).

Synthesis Methods

The systematic review was performed with all eligible studies. When the number of studies investigating a particular emotion regulation strategy was sufficient ($K \geqslant 3$), meta-analysis was performed to evaluate the associations between culture and the spontaneous use frequency of emotion regulation strategies. The remaining strategies that have been studied cross-culturally were synthesized narratively.

The *meta* package (Balduzzi et al., 2019) was used in *R v.4.3*.0 (R Core Team, 2023) to conduct meta-analysis and exploratory analysis. Cohen's *d* was used to summarize the effect size: small ($d \leqslant 0.20$), medium ($0.20 < d < 0.80$), and large ($d \geqslant 0.80$) (Cohen, 1988). The effect size was calculated using means, standard deviations, and sample sizes of the included studies. We added sample sizes together, created weighted means and pooled standard deviations, for the study that has more than one Western country/region or East-Asian country/region before conducting a meta-analysis. Knapp–Hartung adjustments (Knapp & Hartung, 2003) were used to calculate the confidence interval around the pooled effect. The restricted maximum likelihood estimator was used because the effect sizes in this

meta-analysis were based on continuous outcome data. In addition, the variation between the studies for a specific strategy was visualized with a dot-and-whisker plot when these studies ($K \geqslant 3$) used the same scale.

The chi-square (chi^2) tests that are quantified by I^2 statistics were used to assess the heterogeneity of the studies. Following the guide of the Cochrane Handbook (Higgins et al., 2019), a score of 0% to 40%, 30% to 60%, 50% to 90%, and 75% to 100% indicated low, moderate, substantial, and considerable heterogeneity, respectively. Considering that participants were drawn from different countries, a random-effects model was used since heterogeneity between studies was anticipated (Harrer et al., 2021).

Reporting Bias Assessment

Publication bias was checked for strategies where the studies $\geqslant 10$ (Sterne et al., 2011), using the Begg funnel plots and Egger's regression test (Egger et al., 1997). The effect was plotted by the inverse of its standard error for each study, and both graphical and statistical evaluations were used. The existence of publication bias was considered if the asymmetry of the funnel plot, and/or $p<.05$ from the Egger test were found. Finally, Rücker's limit meta-analysis method was used to adjust for small-study effects to attain a corrected effect estimate. However, publication bias was not tested when fewer than 10 studies were considered for the analysis, since the statistical power of the analysis was too low in this case (Higgins et al., 2019; Sterne et al., 2011).

Transparency and Openness

We adhered to the MARS (Meta-Analysis Reporting Standards) guidelines

(American Psychological Association Publications and Communications Board Working Group on Journal Article Reporting Standards, 2008) and the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 guidelines (Page et al., 2021) for systematic reviews and meta-analysis. Data were analyzed using *R v.4.3.0* (R Core Team, 2023) and the *meta* package, version 5.5-0 (Balduzzi et al., 2019). All meta-analytic data and analysis code have been made publicly available on the Open Science Framework and can be accessed at (https://osf.io/pkvjb/?view_only=baab564508504a56a7c3e4e44847c52b). The protocol for this review was pre-registered on PROSPERO. As it is a systematic review with meta-analysis, published aggregated data rather than raw data were used, and this study did not require ethical approval.

Results

Study Selection

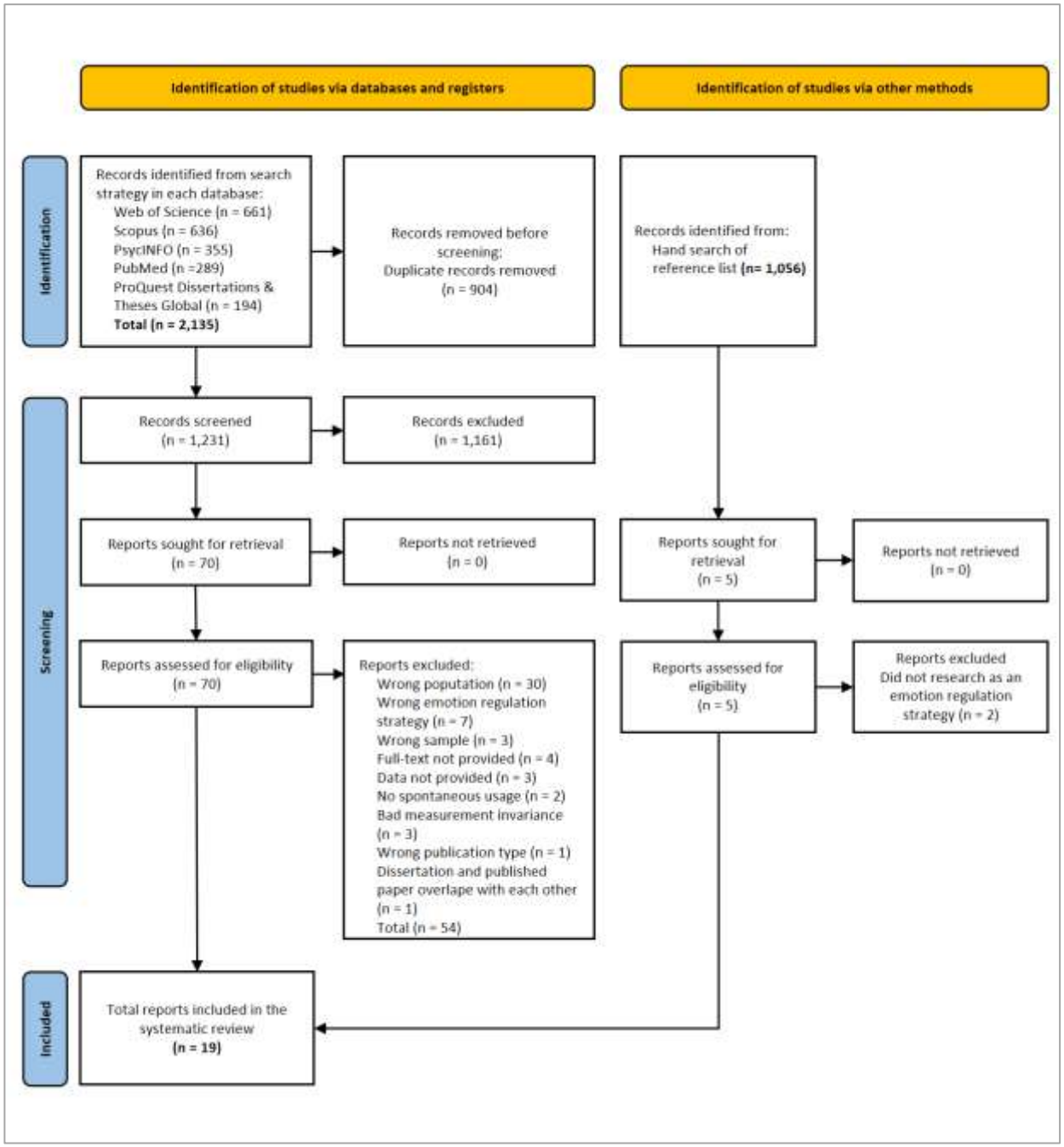
A total of 19 articles involving 21 studies were identified for inclusion in the systematic review. Figure 2.1 presents the study selection process according to the PRISMA 2020 Statement. After title and abstract screening, we identified 70 relevant full-text articles, of which 16 involving 18 studies were found to meet the eligibility criteria. In addition, three articles with three studies that met the criteria for inclusion were identified by checking the reference list of the included papers.

The meta-analysis included 20 of the 21 studies, with one being excluded as it did not examine any strategies that appeared in at least two other papers (Rich et al., 2022). Fourteen studies evaluated suppression, 11 studies evaluated reappraisal, four studies evaluated rumination, four studies evaluated expression, and three

studies evaluated avoidance. The remaining strategies that are acceptance, mindfulness, distraction, and self-compassion, were synthesized narratively. One full-text dissertation that met our inclusion criteria (He, 2020), however, this thesis had also been published as a journal article, therefore, we included the article instead (He et al., 2021). Thus, no unique unpublished study was included in this systematic review and meta-analysis.

Figure 2.1

PRISMA 2020 Flow Diagram of the articles in the review



Study Characteristics and Risk of Bias of the Included Studies

The characteristics of eligible studies are shown in Appendix 2. These articles were published from 2002 to 2023. The 21 studies include data from 37,882 participants. Of these, 17,044 (44.99%) were from 16 Western countries, and 20,838 (55.01%) were from five East-Asian countries and regions. The specific countries and regions included in each of the studies can be found in Appendix 2.

Ten of the included 21 studies had a relatively balanced sex characteristic, between 40% and 60%; 11 studies had an imbalanced sex characteristic, which is less than 40% or over 60% of the sample. These 21 studies had a mean age from 18.69 to 54.4 years, representing a wide age range within each of the samples. All participants reported the spontaneous use frequency of at least one of the nine emotion regulation strategies. Most included studies evaluated suppression (k = 14), with the most commonly used measure being the Emotion Regulation Questionnaire (ERQ, k = 13, Gross & John, 2003); one study used the Positive and Negative Affect Schedule (PANAS, k = 1, Watson et al., 1988) to examine how frequently people suppress expressing a broad range of positive and negative emotions when interacting with others, even though this instrument was designed to measure the frequency of emotional experiences in previous studies. Reappraisal was evaluated in 11 studies, with the most commonly used measure being the ERQ (k = 10, Gross & John, 2003); another study used the modified version of the Ways of Coping Questionnaire (WCQ, k = 1, Folkman et al., 2000). Rumination was evaluated in four studies, three of them used the Perseverative Thinking Questionnaire (PTQ, k = 3, Ehring et al., 2011); another study used the Anger Rumination Scale (ARS, k = 1,

Sukhodolsky et al., 2001). Expression was evaluated in four studies, two of them used the Distress Disclosure Index (DDI, *k* = 2, Kahn & Hessling, 2001); one of them used the Emotional Expressiveness Questionnaire (EEQ, *k* = 1, King & Emmons, 1990); another one used the Affect Valuation Index (AVI, *k* = 1, Tsai et al., 2006) to capture the frequency of expressing positive and negative emotions, even though this instrument was designed to explore the difference between ideal affect and actual affect. Avoidance was evaluated in three studies, with the modified version of the WCQ (*k* = 1, Folkman et al., 2000), the Acceptance and Action Questionnaire-II (AAQ-II, *k* = 1, Bond et al., 2011), and the Maladaptive and Adaptive Coping Style Questionnaire (MAX, *k* = 1, Moritz et al., 2016). Distraction and acceptance were evaluated in one study, with the Emotion Regulation Inventory (ERI, *k* = 1, König, 2011). Mindfulness was evaluated in two comparison studies, with one study using the Mindful Attention Awareness Scale (MAAS, *k* = 1, Brown & Ryan, 2003); and another study using the items of Contemplative Practice Behavior (CPB) created by Rich et al. (2022; *k* = 1), and self-compassion usage was also evaluated by these items in the same study (*k* = 1).

Nine of the included 21 studies specified emotional valence in the assessment of emotion regulation strategies. Two articles involving three studies distinguished between emotional valence when assessing suppression, three studies when assessing expression, one study assessed reappraisal, one study assessed distraction, one study assessed acceptance, and four studies assessed rumination given that the definition of rumination focuses on negative emotions.

Eleven of the 21 studies tested cultural measurement invariance. Two of

them conducted both confirmatory factor analysis (CFA) and exploratory factor analysis (EFA), three of them conducted CFA only, three studies reported they conducted factor analyses, two studies tested congruence coefficients (Tucker's phi), and one study conducted analyses of mean and covariance structures (MACS). In these 11 studies, comparable structures of the measurements were demonstrated in eight studies without adjustment, and three studies removed non-invariant items to achieve comparable structures.

The quality of the 21 eligible studies was evaluated using the Crowe Critical Appraisal Tool. The total percentage score for each study and the score for each category is detailed in Appendix 2. All the studies were included as they were all rated as high quality, with the total score for each study equal to or more than 75%.

Effects of Culture on the Spontaneous Use Frequency of Emotion Regulation Strategies

The meta-analysis evaluated five of the nine strategies because they appeared in three or more studies: suppression, expression, reappraisal, rumination, and avoidance. Data were pooled from 20 of the 21 studies because they identified at least one of these five strategies. We followed Harrer et al. (2021) in our approach to conducting meta-analysis in *R*. The remaining four strategies: acceptance, mindfulness, distraction, and self-compassion; appeared in less than three studies thus were included in the narrative synthesis.

There was no evidence of publication bias for suppression and reappraisal. However, due to the small number of studies, we could not conduct the publication bias analysis for avoidance, rumination, and expression.

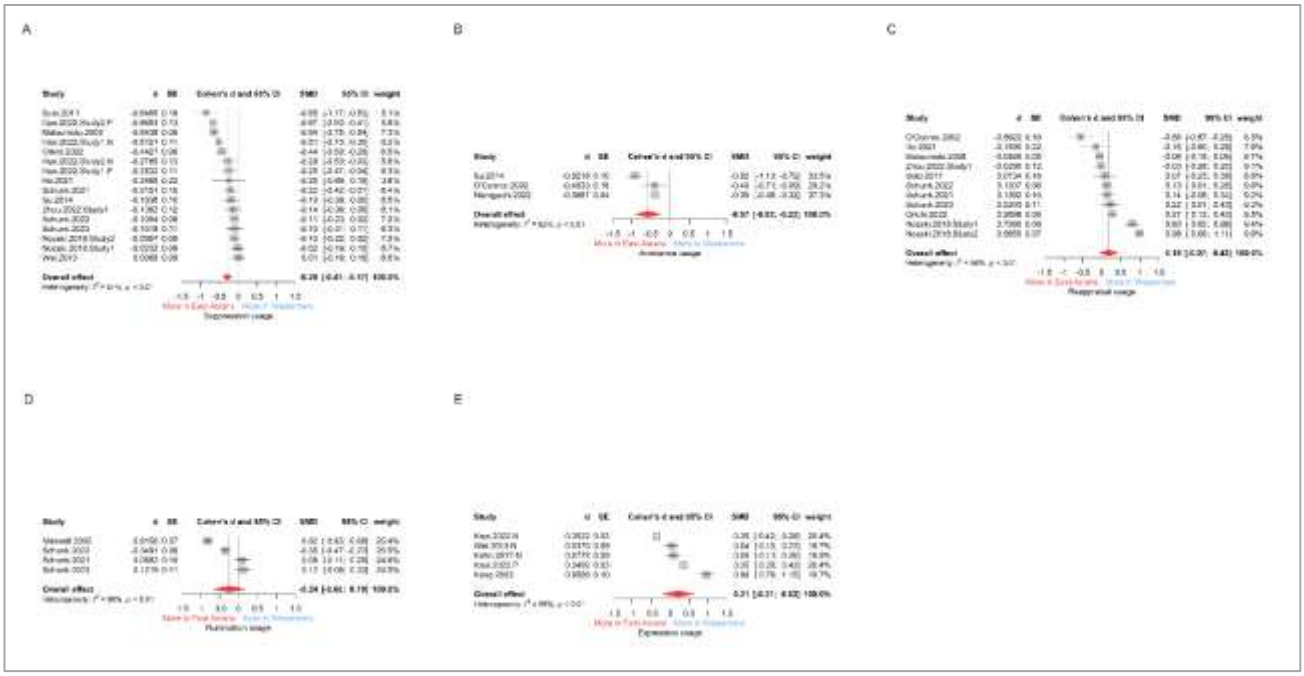
Suppression

The effect of culture on the spontaneous use frequency of suppression, as an emotion regulation strategy, was evaluated in 12 papers involving 14 studies (Han et al., 2022; He et al., 2021; Matsumoto et al., 2008; Nozaki, 2018; Orkibi et al., 2021; Schunk et al., 2021, 2022, 2023; Soto et al., 2011; Su et al., 2014; Wei et al., 2013; Zhou et al., 2022). The pooled data suggest that East-Asian culture was associated with greater use of suppression, with a medium effect size (see Figure 2.2A; Cohen's $d = -0.29$, *95% CI* −0.41 to −0.17). Heterogeneity was significant ($p < .01$, $I^2 = 87\%$). Figure 2.3A shows that there was no significant publication bias in the included studies according to the funnel plot and Egger's regression test ($t = -0.002$, $p = 1.00$).

In studies that used the same scale, the ERQ (Gross & John, 2003), a comparison was made using a dot-and-whisker plot. This was limited to those 13 studies that did not distinguish emotional valence in the assessment of suppression (see Appendix 3). The results were generally consistent with the overall effect, but there were more exceptions in the data on Western culture than in the data on East-Asian culture, which may reflect greater variance in the frequency of suppression use across Western individuals.

Figure 2.2

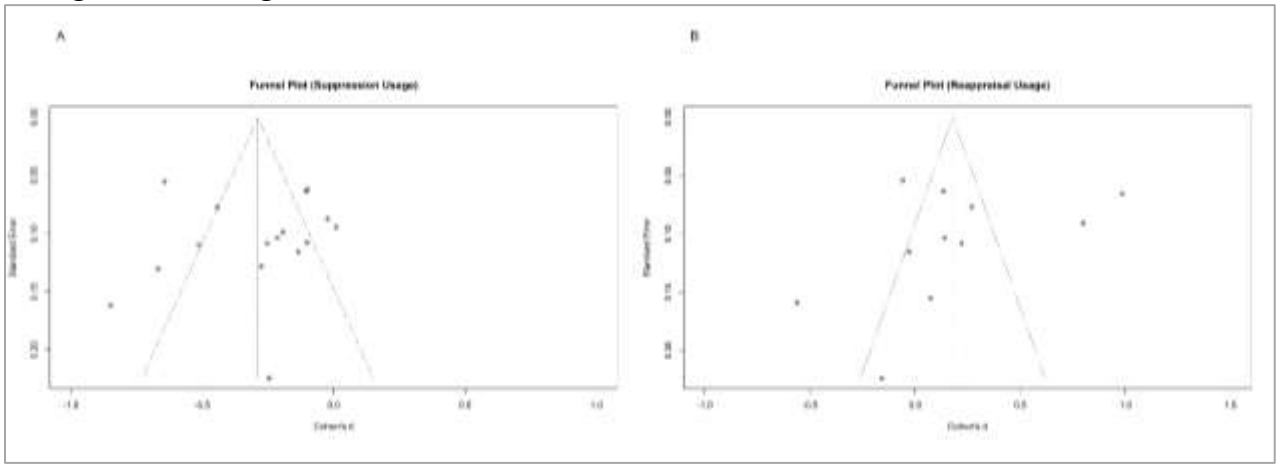
Overall effects of culture on the spontaneous use frequency of emotion regulation strategies.



Note. The square reflects the direction and the strength of evidence in terms of Cohen's *d* (small: $d \leq 0.20$; medium: $0.20 < d < 0.80$; large: $d \geq 0.80$); error bars represent 95% confidence intervals.

Figure 2.3

Publication bias for the effects of culture on the spontaneous use frequency of emotion regulation strategies.



Note. The x-axis represents the effect size (Cohen's *d*), with circles closer to zero indicating smaller effects. The y-axis represents the standard error, which is inversely related to study precision. The vertical line in the middle of the funnel shows the average effect size.

Avoidance

The effect of culture on the spontaneous use frequency of avoidance was examined in three papers involving three studies (Nishiguchi et al., 2022; O'Connor & Shimizu, 2002; Su et al., 2014). The pooled data suggest that East-Asian culture was associated with greater use of avoidance, with a medium effect size (see Figure 2.2B; Cohen's $d = -0.57$, *95% CI* −0.92 to −0.22). Heterogeneity was significant ($p < .01$, $I^2 = 92\%$).

Reappraisal

The effect of culture on the spontaneous use frequency of reappraisal was examined in 10 papers involving 11 studies (He et al., 2021; Matsumoto et al., 2008; Nozaki, 2018; O'Connor & Shimizu, 2002; Orkibi et al., 2021; Schunk et al., 2021, 2022, 2023; Soto et al., 2011; Zhou et al., 2022). The pooled effect size for the spontaneous use of reappraisal was non-significant (see Figure 2.2C; Cohen's $d = 0.18$, *95% CI* −0.07 to 0.43). Heterogeneity was significant ($p < .01$, $I^2 = 96\%$). Figure 2.3B shows that there was no significant publication bias in the included studies according to the funnel plot and Egger's regression test ($t = -0.64$, $p = .54$).

In studies that shared the same scale, the ERQ (Gross & John, 2003), a comparison was made using a dot-and-whisker plot (see Appendix 3). Among 11 studies assessing reappraisal, 10 studies used the ERQ. The results were consistent with the overall effects shown in the forest plot.

Rumination

The effect of culture on the spontaneous use frequency of rumination was examined in four papers involving four studies (Maxwell et al., 2005; Schunk et al.,

2021, 2022, 2023). Meta-analysis suggested a non-significant pooled difference in rumination usage between Western and East-Asian individuals (see Figure 2.2D; Cohen's $d = -0.24$, *95% CI* −0.68 to 0.19). Heterogeneity was significant ($p < .01$, $I^2 = 96\%$).

Expression

The effect of culture on the spontaneous use frequency of expression was examined in four papers involving four studies (Kahn et al., 2017; Kang et al., 2003; Krys et al., 2022; Wei et al., 2013). Meta-analysis suggested a non-significant pooled difference in the use of expression between Western and East-Asian individuals (see Figure 2.2E; Cohen's $d = 0.21$, *95% CI* −0.21 to 0.63). Heterogeneity was significant ($p < .01$, $I^2 = 99\%$).

Narrative Synthesis

Kahn et al., (2017) found that Chinese (Taiwan) use more mindfulness than European Americans with a small effect size (Cohen's $d = -0.2$). A study with a large sample size found similar results in European Americans and Chinese (Rich et al., 2022; Cohen's $d = -0.14$). Within the same sample, this study also found that Chinese individuals use more self-compassion than European Americans (Cohen's $d = -0.39$). Schunk et al. (2022) found that Germans use more acceptance than Japanese (Cohen's $d = 0.31$). Notably, the effect of culture on the spontaneous use frequency of distraction was examined in the same study, with an interesting finding in the case of distinguishing between emotional valences. Japanese reported more use of distraction for positive emotions compared with Germans, with a large effect size (Cohen's $d = -0.89$), but they are similar in the distraction usage for negative

emotions (Cohen's $d = 0.17$).

Discussion

This systematic review and meta-analysis examined the effect of Western and East-Asian cultures on the spontaneous use frequency of nine emotion regulation strategies. There is an outstanding need for a thorough synthesis of cross-cultural evidence in the field of emotion regulation strategy usage. Data were pooled from 21 comparison studies across Western and East-Asian cultures, and only cross-sectional data were included. Overall, our meta-analysis and narrative synthesis support the claim that culture affects the spontaneous use frequency of some emotion regulation strategies, but differences can be observed across strategies.

Impact of Western and East-Asian Cultures on the Use of Emotion Regulation Strategies

Our results showed that East-Asian culture was associated with greater use of suppression, which is consistent with the findings from a previous systematic review (Weiss et al., 2022). This finding is also supported by the experimental results of previous studies that the degree of suppression usage for Chinese was still higher than for British during a laboratory study (He et al., 2021). In addition, we found that East-Asian culture was associated with greater use of avoidance compared with Western culture. This is not surprising since a strong positive association between avoidance and suppression has been found in previous research (Kashdan et al., 2006; Su et al., 2014). Individuals who use more avoidance may minimize and suppress their emotions more frequently (Campbell-Sills et al., 2006;

Hayes et al., 1996).

It is noteworthy that our results of the difference in the use of suppression in Westerners and East-Asians are consistent with the results from a recent systematic review that focused on the comparison of ethnic majorities to ethnic minorities in specific countries (Weiss et al., 2022). This indicates that East-Asian migrants resemble East-Asians much more than European Americans. The possible explanation for this finding is that East-Asian migrants and East-Asians valued low-arousal positive affective states (e.g., calm and peacefulness) more than did Westerners, whereas Westerners valued more high-arousal positive states (e.g., excitement and enthusiasm; Tsai, 2007; Tsai et al., 2006). Tsai (2007) further found that Chinese Americans valued low-arousal positive affective states more than did Chinese, also, Chinese Americans were more interdependent and more likely to suppress the self to adjust to others. Notably, the preference of migrants might depend on the extent to which they engage in and identify with both cultures (Tsai et al., 2000). Therefore, it would be beneficial if future studies could include individual-level measures to explore specific factors contributing to the similarities and differences, rather than oversimplifying migrants as being in the middle of two cultures.

Cultural differences in the use of reappraisal, rumination, and expression were not observed in the present meta-analysis, given that the findings of individual studies were mixed. It would be beneficial if future studies could investigate these strategies further. It is worth noting that, while expression was viewed as an outcome of emotion regulation in some research (Fischer et al., 2004; McDuff et al.,

2021), some studies treat emotional expression as an emotion regulation strategy. For instance, Pennebaker and Smyth (2016) argue that putting our emotional experiences into language and words can help people understand and deal with emotional upheavals to promote positive emotion regulation. In addition, although cultural differences in the use of rumination were not observed by our synthesized results, existing studies indicated that rumination is more likely to predict maladaptive outcomes in Western individuals than in East-Asian individuals, such as worse mental health and lower life satisfaction (Chang et al., 2010; Schunk et al., 2022) and less social support (Kitayama et al., 1997; Schunk et al., 2021).

The narrative synthesis highlights that East-Asian culture is associated with greater spontaneous use of mindfulness and self-compassion, but less acceptance, yet are supported by only one or two studies each; although the evidence of mindfulness and self-compassion is based on a large overall sample size ($n \geqslant$ 6,442). However, given the limited number of studies examining these strategies cross-culturally, the conclusion we can draw on these strategies is tentative, and caution is needed in drawing generalizations. Hence, more studies are needed in the future for the synthetical evidence of these strategies. It is worth noting that, quite different patterns in distraction emerged when differentiating between valences of emotion, even though it was measured in only one study. Given that the relatively less evidence for interpreting the use of distraction for positive and negative emotions in Western and East-Asian individuals, further exploration in the future would be beneficial.

How Culture Shapes Emotion Regulation

Culture shapes emotion regulation through cultural values and socialization practices, influencing the spontaneous use of emotion regulation strategies. First, Westerners and East-Asians may diverge in the degree of interdependent and independent self-construal (Kraus & Kitayama, 2019; Markus & Kitayama, 1991; Tsai & Lu, 2018). Specifically, interdependent self-construal that is encouraged in the collectivistic cultural contexts (e.g., East-Asia) values connecting themselves with others and controlling/minimizing emotions of the self to preserve group harmony (Ramzan & Amjad, 2017; Tsai et al., 2006). Instead, independent self-construal that is encouraged in the individualistic cultural contexts (e.g., the West) values individual goals over group goals and encourages asserting authentic emotions of the self, while suppressing/minimizing emotions may lead to the lack of consistency between the emotional experience and response (Markus & Kitayama, 1991; Ramzan & Amjad, 2017; Soto et al., 2005; Tsai & Lu, 2018). In addition, Western cultures may encourage people to enhance positive emotions and minimize negative emotions, whereas East-Asian cultures may expect people to seek a balance between positive and negative emotions (Kitayama et al., 2000; Miyamoto & Ma, 2011). Accordingly, East-Asian individuals are more likely to use suppression and distraction than Western individuals. Moreover, culture shapes emotion regulation by transmitting cultural norms through socialization practices. For instance, in cultures that emphasize suppression as the "display rule" (e.g., East-Asia), rather than expression (e.g., the West), suppression may have relatively lower costs for East-Asian individuals on social function (Butler et al., 2007; Schunk et al., 2021),

and may even benefit them on interpersonal harmony (Wei et al., 2013). These potential consequences may further lead to more frequent use of suppression in East-Asian individuals.

Based on the findings of the present study, it is possible that the differences in the use of emotion regulation strategies between Western and East-Asian cultures have become less obvious. Culture is defined as an ever-changing system, which means cultural values and norms may change over time to adapt to current social contexts, thereby influencing how individuals regulate their emotions. For example, Zeng and Greenfield (2015) observed a declining tendency in collectivistic cultural values in China, by reviewing the Chinese corpus to summarize the frequency of words related to collectivism (e.g., "sacrifice" and "obedience") from 1970 to 2008. Similarly, the perceived importance of collectivism-related folk beliefs was found to decline in China relative to the past (Xu & Hamamura, 2014). The lack of longitudinal comparison studies across Western and East-Asian cultures on the use of emotion regulation strategies, however, makes it difficult to observe how cultural influences on emotion regulation evolve over time. Therefore, future longitudinal cross-cultural comparison studies would be valuable in understanding the dynamic nature of these processes.

Furthermore, existing studies have examined how culture shapes the neural mechanisms of emotion regulation processes (see reviews, Hampton & Varnum, 2018; Han & Ma, 2014). For instance, European Americans showed increased activation in the ventrolateral prefrontal cortex (VLPFC) during cognitive reappraisal, while Chinese participants showed decreased VLPFC activation (Qu &

Telzer, 2017). Moreover, during suppression, increased skin conductance levels are more likely to emerge in Western participants, but not in East-Asian participants (Soto et al., 2016). However, cultural differences between Western and East-Asian participants were not observed in the late positive potential (LPP) responses by previous studies that examined suppression using electroencephalography (EEG), although East-Asian participants self-reported more suppression usage compared with Western participants (Hampton et al., 2021; Varnum & Hampton, 2017). This shows that self-reported emotion regulation strategy usage does not always match the emotional reaction at the neural level (Hampton et al., 2021; Soto et al., 2016; Varnum & Hampton, 2017). Furthermore, differences in the patterns of neural activity have also been linked with cultural values (see Han & Ma, 2014, for a review). Previous studies indicated that participants with higher levels of interdependent self-construal beliefs (e.g., East-Asians) showed greater activated temporoparietal junction (TPJ) and less activity in the medial prefrontal cortex (mPFC) compared with those with higher levels of independent self-construal (e.g., Westerners), using functional magnetic resonance imaging (fMRI), with the interpretation that the activation of TPJ involves understanding others and the preference of connecting self to others whereas the activation of mPFC is associated with self-relevant information (Chiao et al., 2009; Han & Ma, 2014; Macrae et al., 2004). Apart from brain activity, researchers also observed the possible influence of gene-culture interaction on emotion regulation processes, with the findings that oxytocin receptor polymorphism (OXTR) rs53576 is associated with collectivistic cultural orientation and the tendency to regulate emotions (Kim et al., 2011; Luo &

Han, 2014), although Ishii et al. (2021) found OXTR rs53576 did not moderate cultural differences in emotional expression. Notably, we did not have a chance to include neural relevant studies in the present systematic review since such studies are often conducted in a single country (e.g., Roberts et al., 2008) or did not provide relevant data (e.g., Kim et al., 2011), which did not meet the inclusion criteria of the current study. Therefore, it would be beneficial if the neuro-culture interaction on the use of emotion regulation strategies could be synthesized in future studies

Methodology of the Included Studies

This review has identified a significant gap in the cross-cultural emotion regulation literature. Four emotion regulation strategies were absent from the meta-analyses: mindfulness, acceptance, distraction, and self-compassion; due to the lack of comparison studies across Western and East-Asian cultures on these emotion regulation strategies. Future cross-cultural comparison studies could focus on these strategies.

The current systematic review and meta-analysis only included cross-sectional studies since our focus is the spontaneous use of these emotion regulation strategies. However, it is important to mention that the validity of comparing mean scores across cultural groups with self-report measures has been questioned for decades due to methodological confounds, such as divergent response styles that the midpoint a scale is possible to be answered by individuals from one culture than those from another culture (Chen et al., 1995; Harzing, 2006), translation quality issues (Behr, 2017; Brislin, 1970), and the reference-group effect that the understanding of oneself might be influenced by context-relevant confounds, which

are to compare self with others around (Heine et al., 2002). Cross-cultural comparative research is becoming increasingly popular and researchers should be aware that the prerequisite of observing true cultural differences is to confirm the instrument has the same measurement properties across cultural samples, for instance, conducting CFA and/or EFA to test cultural measurement invariance (Boer et al., 2018; Fischer & Karl, 2019). Notably, the current study shows that the analysis of cultural measurement invariance is ignored in approximately half of the included studies, which increases the risk of yielding meaningless results when comparing individuals from different cultures. Therefore, future studies should conduct invariance analyses to minimize the risk of misleading interpretations of cross-cultural comparative results.

More than half of the included studies did not distinguish between the emotional valences in the examination of emotion regulation strategies. It is a possibility that differences in strategy usage could emerge, depending on the valence of the emotion being controlled, in both East-Asians and the Westerners (Kitayama et al., 2000; Miyamoto & Ma, 2011; Sang et al., 2014). Therefore, it would be beneficial if future emotion regulation research could distinguish between emotional valences when examining the impact of culture on emotion regulation strategy usage.

While significant differences emerged between East-Asian and Western individuals in relation to emotion regulation strategy usage, we acknowledge there are likely to be differences between countries/regions within East-Asia or/and the West, and it is one of the risks of conducting large scale cross-cultural comparison

research. Therefore, future research could investigate the potential cultural differences between countries/regions within either East-Asia or the West in emotion regulation strategy usage, to further elucidate differences that may have been lost in the aggregation across regions.

The present systematic review and meta-analysis move far beyond previous reviews, by conducting a cross-cultural synthesis on the most extensive emotion regulation strategies studied to date. The findings of five emotion regulation strategies (suppression, avoidance, reappraisal, rumination, and expression) offer theoretical insights into how culture shapes specific emotion regulation practices. Moreover, this study identified significant research gaps in the cross-cultural examination of four emotion regulation strategies (mindfulness, acceptance, distraction, and self-compassion), which is a powerful resource to inform the most needed new primary-level research in the field of emotion regulation and cross-culture. Furthermore, our work provided methodological suggestions for future cross-cultural comparison studies in the aspects of analyzing cultural measurement invariance, distinguishing between emotional valences, and more clearly reporting the ethnicity of participants, thereby contributing to more robust and rigorous approaches in this field. In addition, all data, along with detailed *R* code in our work, have been made publicly available online for greater transparency and replicability. By offering a comprehensive and clear framework for conducting relevant analyses in R, our code can contribute to the consistency and comparability of analytical techniques in cross-cultural research, thereby enhancing methodological rigor in this field.

Limitations

This study has several limitations. First, the studies that examined emotion regulation strategies in a single culture were not included, so that it is possible that contrary data exist in studies designed with homogeneous samples. However, these studies rarely make explicit reference to the participants' culture in the title, abstract, or keywords, which makes searching for such studies difficult in systematic reviews. Second, the studies that did not clarify the ethnic composition of American participants were excluded because the ethnic diversity in the American sample might affect the reliability of the results.

Conclusion

The present study that systematically reviewed extensive emotion regulation strategies contributes to identifying research gaps for four emotion regulation strategies (mindfulness, acceptance, distraction, and self-compassion). In addition, the synthetical evidence indicates that culture has a medium effect size with East-Asian individuals using more suppression and avoidance compared with Western individuals, while no significant differences emerged in the use of reappraisal, rumination, and expression. Moreover, we suggest future cross-cultural comparison studies to improve the methodology inadequacies in the aspects of analyzing cultural measurement invariance, distinguishing between emotional valences, and reporting the ethnicity of participants more clearly.

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Chapter Three: A cross-cultural study of self-compassion and the moderating role of alexithymia

Abstract

Self-compassion is an emotion regulation strategy which may be influenced by culture. This study aimed to examine the levels of the two factors of the Self-Compassion Scale (self-compassion and self-coldness) and their associations with cultural values at the individual level in Western and East-Asian cultural contexts, and the possible moderating role of alexithymia. Data were collected from 397 adults from the general population living in Ireland and China. Chinese participants reported more self-compassion and less self-coldness than Irish participants. In the Irish sample, greater horizontal individualism was associated with higher levels of self-compassion; moreover, vertical collectivism was associated with higher levels of self-coldness, whereas the relationships were more complicated in the Chinese sample since both individualistic and collectivistic cultural values were found to be positively correlated with self-compassion and self-coldness. Furthermore, in both samples, marginal interaction effects were found between alexithymia and specific cultural values when predicting self-compassion and self-coldness. Overall, this study highlights the dynamic nature of culture and indicates the understanding of two-factor construct of the Self-Compassion Scale may be influenced by culture. Moreover, this is the first study to explore how alexithymia interacts with cultural values at the individual level to influence self-compassion and self-coldness,

contributing preliminary evidence to the field of cross-cultural alexithymia.

Keywords: self-compassion, self-coldness, cross-culture, alexithymia

Outputs

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Introduction

Self-compassion is a commonly used emotion regulation strategy which has been defined as non-judgmental acceptance of one's own suffering, whilst also directing kindness towards oneself (Neff, 2003a). The self-compassion model was developed by Neff (2003a), characterized by three bipolar components: 1) being supportive and compassionate towards oneself when facing inadequacies and failures (i.e., self-kindness), rather than judgmental and critical toward the self (i.e., self-judgement). 2) Seeing one's experience as a common experience shared by all humans (i.e., common humanity), rather than feeling that the suffering is only happening to oneself (i.e., isolation). 3) Finally, holding painful feelings in balanced awareness, without denying them (i.e., mindfulness); rather than being overwhelmed by the negative thoughts and feelings (i.e., over-identification). A recent systematic review and meta-analysis identified four emotion regulation strategies (self-compassion, distraction, mindfulness, and acceptance) as research gaps in the comparison studies across Western and East-Asian cultures (Song et al., 2024). The current study particularly focuses on self-compassion for several reasons. Firstly, self-compassion has been taken as a highly beneficial strategy that promotes emotional resilience and does not seem to have adverse effects (Austin et al., 2023; Trompetter et al., 2017). However, some strategies, such as distraction, may have potential long-term negative consequences since it prevents individuals from developing skills to cope with emotions in a healthy way, making it more difficult to deal with such unresolved emotions in the future (Craske & Simos, 2013; Wolgast & Lundh, 2017). Secondly, self-compassion is a concept drawn from Eastern

Buddhism, which is growing in the West as a new way of emotion regulation (Neff, 2003a; Neff et al., 2008), offering an opportunity to explore this strategy from a cross-cultural perspective.

Self-compassion is assessed most commonly using the Self-compassion Scale (SCS; Neff, 2003b). The SCS was initially proposed as a one-factor construct that is assessed with a SCS total score (Neff, 2020, 2022; Neff et al., 2019, 2021). Specifically, combining the scores of the three positive components (self-kindness, common humanity, and mindfulness) with the reversed scores of the three negative components (self-judgment, isolation, and over-identification). However, recent research has suggested that the SCS may function as a two-factor scale, namely self-compassion (comprising of the positive components) and self-coldness (comprising of the negative components; (Muris et al., 2016; Muris & Otgaar, 2020, 2022; Muris & Petrocchi, 2017), which has been supported by some factor analytic studies (Brenner et al., 2017; López et al., 2015, 2018). A study by (Fung et al., 2021), based on the two-factor construct of the SCS, found that individuals living in Hong Kong reported higher levels of self-compassion than those living in the United States, whereas cultural differences in the level of self-coldness were not observed. In the same study, a negative correlation between self-compassion and self-coldness was observed in the United States, whereas a positive correlation between these two factors was observed in Hong Kong.

Self-compassion and self-coldness are based on an attitude towards the “self” which can be seen as a cultural product (Heine, 2003; Kitayama et al., 2022; Markus & Kitayama, 1991). Cultural norms and expectations regarding the ideal "self" vary

(Wang & Lou, 2022), resulting in individuals thinking and acting in ways consistent with their culturally shared values (Gilbert et al., 2011; Hofstede et al., 2010). The most widely studied cultural values, that are closely related to the "self", are individualism and collectivism. According to a recent systematic review (Song et al., 2024), the empirical comparison studies often dichotomise the countries as either collectivistic or individualistic rather than measuring the cultural values of each participant from each cultural context. For instance, according to the popular cultural model of Hofstede et al., (2010), Western countries tend to be more individualistic (e.g., Ireland), whereas East-Asian countries tend to be more collectivistic (e.g., China). However, considering members of a society may endorse different cultural values, the conventional idea at the national level may lead to a narrow interpretation of cultural differences (Oyserman et al., 2002). Individualistic cultures encourage an independent self and prioritize individual goals whereas collectivistic cultures value an interdependent self and tend to emphasize group goals and harmony (Greenfield et al., 2003; Markus & Kitayama, 1991). Furthermore, individualistic and collectivistic cultural values can be explored from both horizontal and vertical orientations. Horizontal orientation emphasizes equality, whereas vertical orientation emphasizes social competition and hierarchy (Singelis, 1994; Triandis & Gelfand, 1998). Specifically, people who endorse horizontal collectivism (HC) value harmony and equality within the group; people who endorse vertical collectivism (VC) tend to keep group harmony, but they accept, and expect, unequal status within the group. In terms of the two orientations to individualism, people who endorse horizontal individualism (HI) value individual goals over group

goals while also valuing equality among individuals; people who endorse vertical individualism (VI) emphasize individual goals and tend to compare themselves with others. The group harmony valued by collectivistic cultures may be associated with interconnectedness in the group and foster self-compassion, whereas independence and the pursuit of individuality over group goals encouraged by individualism may be associated with isolated interpersonal relationships and foster self-coldness (Montero-Marin et al., 2018; Steindl et al., 2020; Wollast et al., 2021).

Alexithymia is a transdiagnostic mental health difficulty that has three core components: difficulties in identifying feelings (DIF), difficulties in describing feelings (DDF), and externally oriented thinking (EOT; Bagby et al., 1994). Alexithymia is associated with a wide range of psychological disorders, including anxiety, depression, eating disorders, and substance abuse (Honkalampi et al., 2018; Taylor et al., 1999). Individuals high in alexithymia often have limited emotional awareness, which can impair their ability to recognize what emotions they are experiencing (attention stage) and how to interpret them appropriately (appraisal stage), thereby limiting the employment of effective emotion regulation strategies (Panayiotou et al., 2019; Preece et al., 2023). Therefore, previous studies have suggested that individuals with alexithymia tend to rely on maladaptive emotion regulation strategies (e.g., suppression and avoidance) rather than adaptive ones such as cognitive reappraisal and self-compassion (Laloyaux et al., 2015; Lyvers et al., 2020; Preece et al., 2023; Stasiewicz et al., 2012; Swart et al., 2009). Alexithymia may interact with culture to influence emotion regulation process (Dere et al., 2012; Le et al., 2002). For example, individuals from collectivistic cultures

that highly value group harmony may experience more interpersonal stress than those from individualistic cultures that value self-focus, which may lead to more self-judgment and self-criticism in individuals with alexithymia since they have more difficulties in emotion regulation process (Taylor et al., 1999). By comparison, individualism may help those with alexithymia improve emotional awareness through self-focus and self-care, thus fostering self-kindness (Brewer et al., 2016; Coriale et al., 2012; Panayiotou et al., 2015).

Present Study

A recent systematic review pointed out the lack of comparison studies across Western and East-Asian cultures on self-compassion in the existing literature (Song et al., 2024). To address this gap, the present study investigated the levels of the two factors of the SCS (self-compassion and self-coldness) and their relations to cultural values in the cultural contexts of Ireland and China, and whether these relationships would be moderated by alexithymia. With the consideration that most of the cross-cultural comparison studies relied on cultural beliefs at the national level rather than cultural values at the individual level (Song et al., 2024), the present study not only collected information about country of residence, but also assessed cultural values at the individual level, to be aware of the variability within cultural groups. We hypothesized Chinese participants would report higher levels of self-compassion than Irish participants, while there would be no cultural difference in the level of self-coldness. We also hypothesized individuals who report higher levels of collectivistic cultural values (HC and VC) would report higher levels of self-compassion, and those who report higher levels of individualistic cultural values (HI

and VI) would report higher levels of self-coldness, in both samples. Moreover, we examined whether these relationships would be moderated by alexithymia, as an exploration.

Methods

Participants and Procedure

This study employed a cross-sectional and cross-cultural design. Ethical approval for this study was obtained from the local ethics committees. Informed consent was obtained from all participants included in this study. All data were collected online using Qualtrics™ which is an online survey tool. Participants were recruited from the general population by posting advertisements on social media platforms in China and Ireland. Participation in this study was completely voluntary and unpaid. As the inclusion criteria, participants were adults aged 18 and over and had never previously attended any self-compassion/mindfulness training. Participants recruited in Ireland were those whose nationality and residence were both Ireland, and their first language was English. Participants recruited in China were those whose nationality and residence were both China, and their first language was Mandarin.

Initially, 418 participants completed the survey with no missing data, 280 of which were recruited in China, 138 of which were recruited in Ireland. Given the risk of inattentive responding in online surveys (Johnson, 2005; Kurtz & Parrish, 2001), the *responsePatterns* package was used in *R v.4.3.0* (R Core Team, 2023) to conduct auto-correlation screening for the detection of repetitive response pattern

(Gottfried et al., 2022). After running this protocol validity check, 21 participants were removed to enhance data quality. The final sample of this study consists of 397 adults, of which 260 adults in China (age: $M = 27.65$, $SD = 9.71$, 60.77% Females, 100% Chinese) and 137 adults in Ireland (age: $M = 31.12$, $SD = 10.50$, 60.58% Females, 94.89% White).

Considering the unbalanced sample sizes between the two countries, we conducted data analyses both with the raw dataset and the balanced dataset (i.e., A random down-sampling of the Chinese sample size of 260 to 137 was performed once). We found the results did not differ significantly between the raw data and the balanced data, therefore only results of the raw dataset were reported. The results of balanced data are available in the Appendix 4.

Measures

All scales used in the present study were already available in both English and Chinese languages; therefore, no translation was necessary.

Self-Compassion and Self-Coldness

The Self-compassion Scale (SCS; Neff, 2003b) involving 26 items consists of six subscales with three subscales assessing self-compassion (self-kindness, common humanity, and mindfulness), and three subscales assessing self-coldness (self-judgment, isolation, and over-identification). Each item is scored on a 5-point Likert scale, ranging from 1 “Almost never” to 5 “Almost always”. Higher scores indicate higher levels of self-compassion or self-coldness. The Chinese version was developed by Chen et al. (2011). In this study, internal consistency was good for both self-compassion ($\alpha \geq 0.90$) and self-coldness ($\alpha \geq 0.89$), for both countries.

Cultural Values

The Individualism and Collectivism Scale (INDCOL; Singelis et al., 1995) was used, which consists of 32-items across four subscales: Horizontal Individualism (HI), Vertical Individualism (VI), Horizontal Collectivism (HC), and Vertical Collectivism (VC). All items were scored on a 9-point Likert scale from 1 "Never or definitely no" to 9 "Always or definitely yes". Higher scores indicate more endorsement of specific cultural values. The Chinese version of the INDCOL was developed by (Renzhi et al., 2013). In the present study, the internal consistency of the scales in both countries were moderate to good ($\alpha \geq 0.68$) except for the Horizontal Individualism scale in the Irish sample, which was moderate ($\alpha = 0.53$).

Alexithymia

The Toronto Alexithymia Scale-20 (TAS-20; Bagby et al., 1994) consists of 20 self-report items that load onto three subscales: difficulties in identifying feelings (DIF), difficulties in describing feelings (DDF), and externally oriented thinking (EOT). As suggested, total score was computed across all items in this study. All items were scored on a 5-point Likert scale from 1 "Strongly disagree" to 5 "Strongly agree". Higher scores indicate higher levels of alexithymia. The cross-cultural equivalence of the TAS-20 has been supported among Asians and Westerners in previous research (Chan et al., 2023). The psychometric properties of the Chinese version of the TAS-20 have been shown to be satisfactory among Chinese individuals (Jinyao et al., 2003). In our sample, Cronbach alphas calculations of internal reliability were good in Ireland ($\alpha = 0.85$) and China ($\alpha = 0.86$).

Cultural Measurement Equivalence

In order to test structural measurement equivalence across countries, congruence coefficients (Tucker's phi) were computed in *R v.4.3.0* (R Core Team, 2023) for each observed variable across China and Ireland the procedure suggested by Fischer and Karl (2019) was followed. The results can be found in Table 3.1. Normally, Tucker's phi value which below 0.80 could be interpreted as indicative of factor incongruence, even though there are several proposed cut-off values between 0.80 to 0.95 rather than an existing formal threshold criterion (Fischer & Karl, 2019; Lorenzo-Seva & ten Berge, 2006; Lovik et al., 2020). All measurements in the present study showed values above 0.80, indicating factor similarity across cultures.

Data Analysis

All data analysis in the current study were conducted in *R v.4.3.0* (R Core Team, 2023). Firstly, independent-samples *t*-tests were conducted for observed variables to examine whether cultural differences exist. Next, Pearson's correlations were performed to examine intercorrelations between observed variables within Chinese and Irish samples. Finally, for both samples, two separate hierarchical multiple regressions were conducted with self-compassion and self-coldness serving as dependent variables. The continuous predictors (HI, VI, HC, VC, alexithymia, and age) were mean centered, the categorical predictor (gender) was dummy coded as 0 = Male and 1 = Female. In each model, gender and age were entered in Step 1, followed by cultural values in Step 2, and alexithymia in Step 3, and interaction terms of cultural values and alexithymia in Step 4.

Results

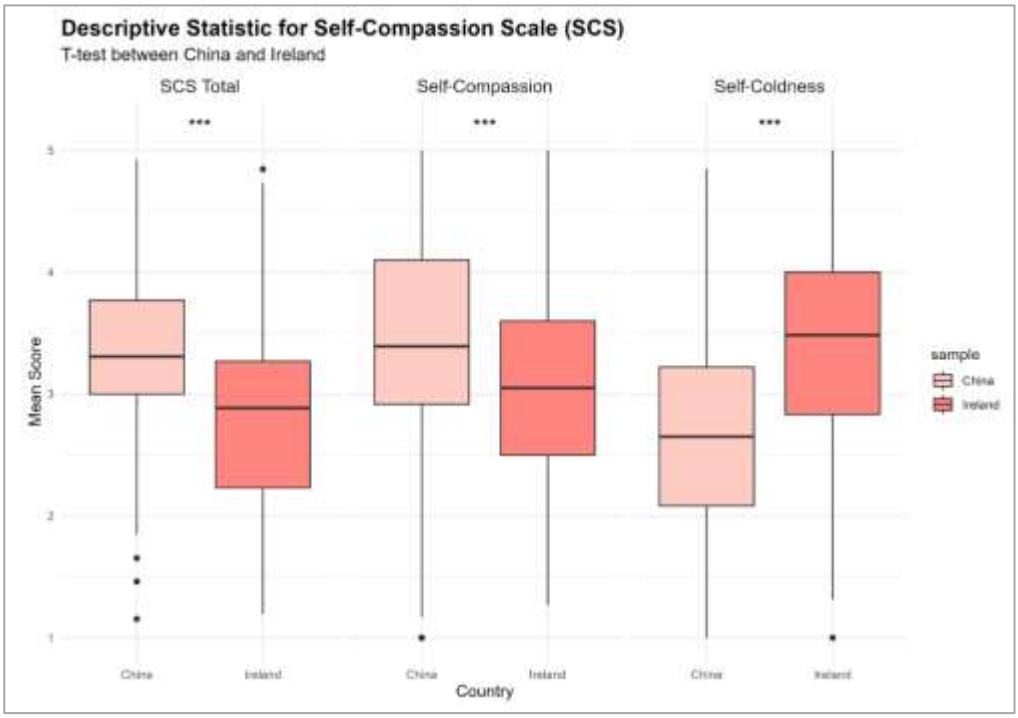
Country Differences

Mean level and internal consistency of each observed variable by country can be found in Table 3.1. Chinese participants reported higher levels of self-compassion [$t(395) = 4.34$, $p < .001$] and lower levels of self-coldness [$t(395) = -7.87$, $p < .001$] compared to the Irish participants. In addition, we checked whether the SCS worked for both samples as both two-factor and one-factor SCS constructs (see Figure 3.1). Self-compassion and self-coldness differed in distribution across samples, additionally, the correlation between self-compassion and self-coldness was not significant ($r = -.06$) in the Chinese sample, therefore we retained the two-factor construct in the analysis. Figure 3.1 showed the dissociation across Ireland and China between the positive components (referred to as self-compassion) and negative components (referred to as self-coldness) of the SCS, supporting the two-factor construct of the SCS taken in the present study.

For the other interested variables, the Chinese sample reported lower levels of HI [$t(395) = -7.10$, $p < .001$] and higher levels of VC [$t(395) = 3.24$, $p < .001$] compared to the Irish sample. Interestingly, the Chinese sample reported slightly lower levels of HC [$t(395) = -2.18$, $p = .03$] compared to the Irish sample, and the mean levels of VI did not differ across cultures ($p = .68$). Moreover, there was no difference in the levels of alexithymia between the two samples.

Figure 3.1

Descriptive statistic for the Self-Compassion Scale.



Note. SCS Total: the total score of the SCS; Self-Compassion: the positive items of the SCS; Self-Coldness: the negative items of the SCS; *$p < .05$; **$p < .01$; ***$p < .001$.

Intervariable Correlations

Intercorrelations between observed variables by country were presented in Table 3.1, which are also visualized with correlation matrix heat maps (see Figure 3.2). In the Irish sample, positive correlations between HI and self-compassion ($r = .32$, $p < .01$), and between VC and self-coldness ($r = .34$, $p < .001$) were observed. In the Chinese sample, almost all cultural values positively correlated with self-compassion and self-coldness, with the only exception being VI, which did not correlate with self-compassion.

Table 3.1

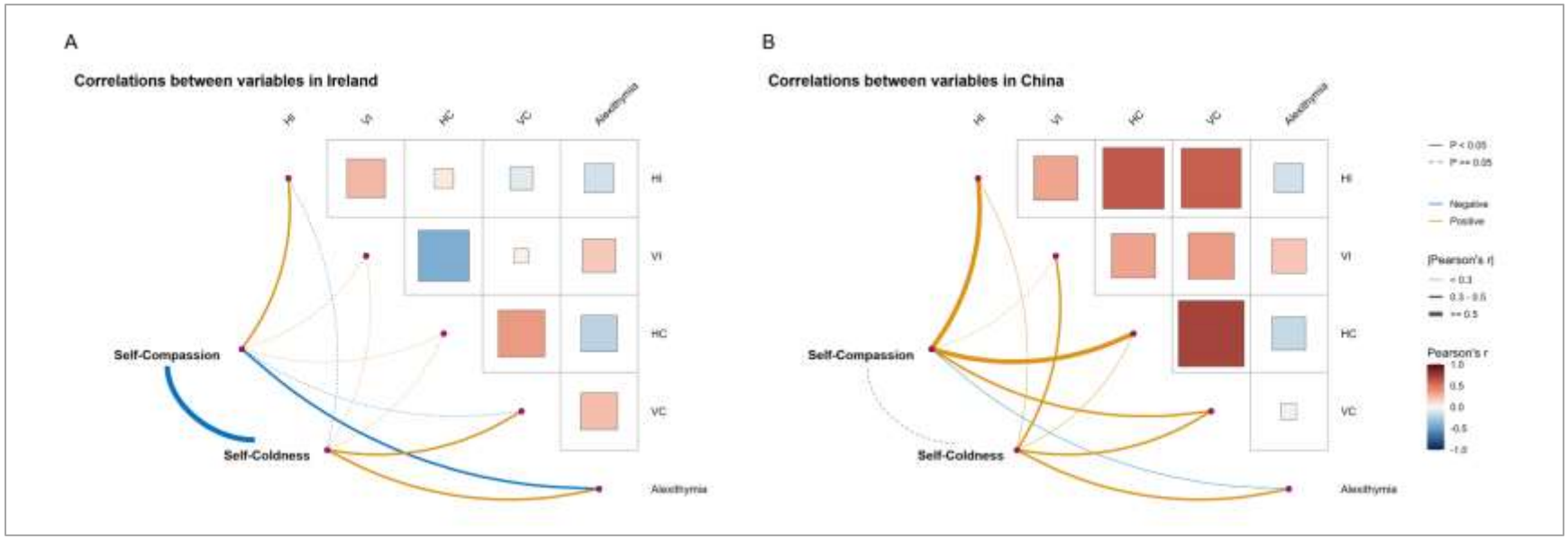
Cultural mean differences, internal consistencies, cultural measurement equivalence, and Pearson's correlations by country.

Variable	*M*	*SD*	*α*	φ	1	2	3	4	5	6	7
	China										
1. Self-Compassion	3.43	0.89	.92	.99	1	-	-	-	-	-	-
2. Self-Coldness	2.68	0.84	.89	.99	-0.06	1	-	-	-	-	-
3. HI	5.71	1.56	.80	.94	0.61***	0.18*	1	-	-	-	-
4. VI	4.63	1.33	.68	.94	0.11	0.40***	0.32***	1	-	-	-
5. HC	5.53	1.56	.81	.98	0.54***	0.17*	0.62***	0.32***	1	-	-
6. VC	5.36	1.55	.77	.94	0.46***	0.32***	0.59***	0.35***	0.72***	1	-
7. Alexithymia	52.49	12.44	.86	.99	-0.25***	0.39***	-0.14	0.20*	-0.18*	-0.04	1
	Ireland										
1. Self-Compassion	3.04	0.79	.90	.95	1	-	-	-	-	-	-
2. Self-Coldness	3.39	0.88	.93	.97	-0.65***	1	-	-	-	-	-
3. HI	6.73	0.84	.53	.89	0.32**	-0.10	1	-	-	-	-
4. VI	4.70	1.77	.87	.98	0.06	0.06	0.25	1	-	-	-
5. HC	5.87	1.30	.81	.81	0.14	0.09	0.06	-0.43***	1	-	-
6. VC	4.86	1.25	.73	.89	-0.11	0.34***	-0.09	0.03	0.36***	1	-
7. Alexithymia	51.45	12.09	.85	.96	-0.38***	0.46***	-0.14	0.19	-0.22	0.23	1

Note. α = Cronbach's alpha; φ= Tucker's phi; HI = Horizontal Individualism; VI = Vertical Individualism; HC = Horizontal Collectivism; VC = Vertical Collectivism; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Figure 3.2

Pearson's correlations between variables in Ireland and China.



Note. Correlation matrix heat maps for Ireland **(A)** and China **(B)**; Blue line means negative correlation, orange line means positive correlation; The thicker the line, the greater the correlation. Solid line means the correlation is significant, dashed line means the correlation is not significant; Red square means positive correlation, blue square means negative correlation. HI = Horizontal Individualism; VI = Vertical Individualism; HC = Horizontal Collectivism.

Moderation Effects

As presented in Table 3.2, a slight interaction effect between cultural values and alexithymia on self-compassion was observed in Chinese sample [$F(4, 241) = 2.71$, $p = .03$, $\Delta R^2 = .03$)], with the interaction between HI and alexithymia ($b = 0.009$, $p < .01$). For Irish sample, a slight interaction effect between cultural values and alexithymia on self-compassion was also observed [$F(4, 119) = 3.12$, $p = .02$, $\Delta R^2 = .08$)], with the interaction between VI and alexithymia ($b = 0.01$, $p < .01$). As shown in Table 3.3, although a significant interaction was observed between VC and alexithymia ($b = 0.006$, $p < .05$) in Chinese sample, and between VI and alexithymia ($b = -0.01$, $p < .01$) in Irish sample, these cultural values as a group was not substantial enough to make the overall model improvement significant in both samples when predicting self-coldness. Additionally, Variance Inflation Factors (VIF) for all of the predictors were less than five indicating an absence of multicollinearity (Meyers et al., 2017).

Table 3.2

Multiple regression analyses (by country) examining the moderating effects of alexithymia on the relation between cultural values and self-compassion

Dependent variable	China					Ireland				
Predictor	*B*	*SE B*	95% CI	*t*	ΔR^2	*B*	*SE B*	95% CI	*t*	ΔR^2
Step 1					0.007					0.02
Age	0.007	0.006	[-0.004, 0.02]	1.28		0.002	0.006	[-0.01, 0.01]	0.34	
Gender	-0.001	0.11	[-0.22, 0.22]	-0.01		-0.23	0.14	[-0.51, 0.04]	-1.67	
Step 2					0.40^{***}					0.12^{**}
Age	-0.0008	0.005	[-0.01, 0.008]	-0.17		0.005	0.006	[-0.007, 0.02]	0.80	
Gender	-0.04	0.09	[-0.22, 0.14]	-0.43		-0.20	0.14	[-0.47, 0.07]	-1.45	
HI	0.26	0.04	[0.19, 0.33]	7.04^{***}		0.21	0.08	[0.05, 0.38]	2.51^{*}	
VI	-0.10	0.04	[-0.18, -0.03]	-2.91^{**}		0.05	0.04	[-0.04, 0.14]	1.12	
HC	0.15	0.04	[0.07, 0.24]	3.54^{***}		0.12	0.06	[-0.007, 0.24]	1.88	
VC	0.02	0.04	[-0.07, 0.10]	0.40		-0.11	0.06	[-0.23, 0.007]	-1.86	
Step 3					0.02^{*}					0.06^{**}
Age	-0.003	0.005	[-0.01, 0.006]	-0.70		0.007	0.006	[-0.005, 0.02]	1.09	
Gender	-0.04	0.09	[-0.21, 0.14]	-0.42		-0.17	0.13	[-0.43, 0.09]	-1.28	
HI	0.25	0.04	[0.18, 0.32]	6.79^{***}		0.20	0.08	[0.04, 0.36]	2.43^{*}	
VI	-0.08	0.04	[-0.15, -0.01]	-2.27^{*}		0.06	0.04	[-0.03, 0.14]	1.37	
HC	0.13	0.04	[0.04, 0.22]	2.97^{**}		0.08	0.06	[-0.05, 0.20]	1.22	
VC	0.03	0.04	[-0.05, 0.12]	0.75		-0.05	0.06	[-0.17, 0.07]	-0.79	
Alexithymia	-0.01	0.004	[-0.02, -0.002]	-2.57^{*}		-0.02	0.006	[-0.03, -0.006]	-2.93^{**}	
Step 4					0.03^{*}					0.08^{*}
Age	-0.001	0.005	[-0.01, 0.008]	-0.27		0.007	0.006	[-0.005, 0.02]	1.15	
Gender	-0.01	0.09	[-0.19, 0.16]	-0.13		-0.17	0.13	[-0.43, 0.08]	-1.35	
HI	0.26	0.04	[0.18, 0.33]	6.97^{***}		0.22	0.08	[0.06, 0.38]	2.66^{**}	
VI	-0.07	0.04	[-0.14, 0.003]	-1.90		0.06	0.04	[-0.02, 0.15]	1.49	
HC	0.14	0.04	[0.05, 0.22]	3.19^{**}		0.06	0.06	[-0.07, 0.19]	0.93	
VC	0.02	0.04	[-0.06, 0.11]	0.50		-0.02	0.06	[-0.14, 0.10]	-0.28	
Alexithymia	-0.007	0.004	[-0.01, 0.0001]	-1.95		-0.02	0.008	[-0.04, -0.002]	-2.25^{*}	
HI × Alexithymia	0.009	0.003	[0.003, 0.02]	3.13^{**}		0.005	0.007	[-0.01, 0.02]	0.63	
VI × Alexithymia	-0.001	0.003	[-0.007, 0.004]	-0.54		0.01	0.004	[0.003, 0.02]	2.83^{**}	
HC × Alexithymia	-0.004	0.003	[-0.01, 0.001]	-1.48		-0.002	0.005	[-0.01, 0.008]	-0.46	
VC× Alexithymia	-0.003	0.003	[-0.008, 0.003]	-0.95		-0.002	0.005	[-0.01, 0.008]	-0.36	

Note. HI = Horizontal Individualism; VI = Vertical Individualism; HC = Horizontal Collectivism; VC = Vertical Collectivism; CI = confidence interval; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Table 3.3

Multiple regression analyses (by country) examining the moderating effects of alexithymia on the relation between cultural values and self-coldness

Dependent variable	China					Ireland				
Predictor	*B*	*SE B*	95% CI	*t*	ΔR^2	*B*	*SE B*	95% CI	*t*	ΔR^2
Step 1					0.01					0.02
Age	-0.008	0.005	[-0.02, 0.003]	-1.50		-0.007	0.007	[-0.02, 0.007]	-1.05	
Gender	-0.09	0.11	[-0.30, 0.12]	-0.84		0.22	0.16	[-0.08, 0.53]	1.44	
Step 2					0.19^{***}					0.12^{**}
Age	-0.008	0.005	[-0.02, 0.002]	-1.61		-0.01	0.007	[-0.03, 0.002]	-1.63	
Gender	0.007	0.10	[-0.19, 0.20]	0.07		0.14	0.15	[-0.16, 0.45]	0.95	
HI	-0.03	0.04	[-0.11, 0.05]	-0.64		-0.04	0.09	[-0.23, 0.15]	-0.41	
VI	0.21	0.04	[0.13, 0.28]	5.20^{***}		0.02	0.05	[-0.07, 0.12]	0.48	
HC	-0.09	0.05	[-0.18, 0.007]	-1.83		0.03	0.07	[-0.11, 0.17]	0.41	
VC	0.19	0.05	[0.09, 0.28]	3.97^{***}		0.24	0.07	[0.11, 0.37]	3.62^{***}	
Step 3					0.10^{***}					0.13^{***}
Age	-0.002	0.005	[-0.01, 0.007]	-0.44		-0.01	0.006	[-0.03, -0.001]	-2.19^{*}	
Gender	0.006	0.09	[-0.18, 0.19]	0.06		0.10	0.14	[-0.18, 0.38]	0.70	
HI	-0.001	0.04	[-0.08, 0.07]	-0.03		-0.02	0.09	[-0.19, 0.16]	-0.20	
VI	0.15	0.04	[0.08, 0.23]	4.02^{***}		0.007	0.05	[-0.08, 0.10]	0.15	
HC	-0.03	0.05	[-0.12, 0.06]	-0.67		0.10	0.07	[-0.03, 0.23]	1.49	
VC	0.15	0.04	[0.06, 0.24]	3.40^{***}		0.13	0.07	[0.004, 0.26]	2.05^{*}	
Alexithymia	0.02	0.004	[0.02, 0.03]	6.00^{***}		0.03	0.007	[0.02, 0.04]	4.72^{***}	
Step 4					0.02					0.05
Age	-0.003	0.005	[-0.01, 0.007]	-0.60		-0.01	0.006	[-0.03, -0.0009]	-2.12*	
Gender	0.002	0.09	[-0.18, 0.19]	0.03		0.10	0.14	[-0.17, 0.37]	0.73	
HI	-0.006	0.04	[-0.08, 0.07]	-0.16		0.0003	0.09	[-0.17, 0.17]	0.003	
VI	0.14	0.04	[0.07, 0.22]	3.72^{***}		-0.02	0.05	[-0.11, 0.07]	-0.38	
HC	-0.03	0.05	[-0.12, 0.06]	-0.72		0.08	0.07	[-0.06, 0.21]	1.09	
VC	0.16	0.04	[0.07, 0.25]	3.60^{***}		0.11	0.07	[-0.01, 0.24]	1.76	
Alexithymia	0.02	0.004	[0.01, 0.03]	5.27^{***}		0.03	0.009	[0.01, 0.05]	3.13^{**}	
HI × Alexithymia	-0.004	0.003	[-0.01, 0.002]	-1.38		0.005	0.008	[-0.01, 0.02]	0.68	
VI × Alexithymia	-0.0006	0.003	[-0.006, 0.005]	-0.21		-0.01	0.004	[-0.02, -0.003]	-2.82^{**}	
HC × Alexithymia	-0.0007	0.003	[-0.007, 0.005]	-0.24		-0.006	0.006	[-0.02, 0.005]	-1.15	
VC× Alexithymia	0.006	0.003	[0.0004, 0.01]	2.09^{*}		-0.0003	0.005	[-0.01, 0.01]	-0.07	

Note. HI = Horizontal Individualism; VI = Vertical Individualism; HC = Horizontal Collectivism; VC = Vertical Collectivism; CI = confidence interval; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Discussion

The present study investigated the levels of self-compassion and self-coldness and their relations to cultural values in Ireland and China, and whether alexithymia plays a moderating role between these relationships. Overall, Chinese participants reported higher levels of self-compassion and lower levels of self-coldness than the Irish participants. Furthermore, the relationships between cultural values and self-compassion/self-coldness were more complicated in China than in Ireland. Moreover, marginal interaction effects were found between alexithymia and specific cultural values when predicting self-compassion and self-coldness in both Ireland and China.

The Chinese participants self-reported higher levels of VC and lower levels of HI compared to Irish participants, which is consistent with the conventional idea in the popular cultural model of Hofstede et al. (2010) that differentiated nation-level power distance from the most widely studied individualism-collectivism. Power distance was defined as the extent to which the less powerful members of a society accept and/or expect unequal power distribution (Hofstede et al., 2010), which is similar to the horizontal and vertical cultural dimensions in the current study (Singelis et al., 1995). According to the latest updated nation-level scores in the Hofstede's model (Hofstede, 2023), relatively high power distance, along with relatively low individualism (China: power distance score = 80, individualism score = 43) suggests that they are more likely to accept inequalities and prioritize group goals (i.e., VC), whereas relatively low power distance, combined with relatively

high individualism (Ireland: power distance score = 28, individualism score = 58) indicates a desire to minimize inequalities among people and prioritize individual goals (i.e., HI). Therefore, among four cultural values examined at the individual level in the present study, VC is more likely to be representative of the mainstream values in the cultural context of China, and HI is more likely to be representative of the mainstream values in the cultural context of Ireland, which were supported by our findings at the individual level that relatively high levels of VC in Chinese sample and relatively high levels of HI in Irish sample.

Nevertheless, it cannot be ignored that the differences in the nation-level individualism scores between China and Ireland have become less obvious over time, from 1970s (Hofstede et al., 2010; China score = 20, Ireland score = 70) to 2023 (Hofstede, 2023; China score = 43, Ireland score = 58). The trends of these changes may be reflected by our findings at individual level that Chinese sample reported slightly less HC and similar VI compared to Irish sample, although the Hofstede's model did not update the power distance scores at the national level. Our findings in HC were similar to a study by Green et al. (2005), which linked competitiveness with individualism-collectivism and observed that interdependent non-competition was more common in Western countries than in China. More recently, Vignoles et al. (2016) compared a broad range of Western and Asian countries and found that Westerners are more likely to sacrifice self-interest for the commitment to others than Asians, and the tendency to sacrifice oneself is often taken as an affective bond among those who endorse more collectivistic cultural values (Suzuki & Greenfield, 2002). Furthermore, previous studies have provided

evidence that individualism-collectivism in China has changed over the past few decades. For example, in the study of Zeng and Greenfield (2015) focused on the changes of cultural values in China from 1970 to 2008, the frequency of words indexing collectivistic cultural values (e.g., ‘sacrifice’, ‘help’, ‘obedience’, and ‘communal’) were found declined in the Chinese corpus, and the words indexing individualistic cultural values (e.g., ‘get’, ‘compete’, ‘fair’, and ‘private’) were found increased in frequency. Similarly, folk-beliefs associated with collectivism were perceived as less important in China compared to the past, and those associated with individualism were taken as more important topics (Xu & Hamamura, 2014). Those cultural value shifts maybe driven by the increasing levels of urbanism, wealth and formal education in China, during the reform from a planned economy that emphasized group-interest and self-restraint to a market economy that emphasized self-development and social initiative (Chen et al., 2009; Inglehart & Baker, 2000; Sun & Wang, 2010; Xu & Hamamura, 2014; Zeng & Greenfield, 2015). Additionally, the similar changes over time in individualism-collectivism was also shown in other East-Asian cultural contexts, such as Japan (Hamamura, 2012; Ogihara, 2017). Therefore, our findings highlight the importance of treating cultural values as dynamic, changing over time to adapt to changes in the current social context (Causadias et al., 2018; Kashima, 2016; Kashima et al., 2019).

As expected, individuals living in China reported higher levels of self-compassion, which is consistent with the results of the previous studies that compared Westerners with East-Asians (Birkett, 2013; Fung et al., 2021). In addition, the present study showed lower levels of self-coldness in Chinese

participants than in Irish participants, which is inconsistent with previous research which did not demonstrate significant difference in self-coldness between participants in Hong Kong and those in the United States (Fung et al., 2021). However, given that Hong Kong may be influenced by both East-Asian and Western cultures due to British colonialism, cultural differences may be diluted. The greater exposure to Buddhist tradition that emphasizes understanding and acceptance of oneself might encourage Asians to practice self-compassion more frequently (Gallagher & Shear, 1999; Neff et al., 2021). Moreover, in a culture values long-term orientation (e.g., China), people tend to link the challenges and rewards in the future with how they treat the present and the past, thereby positive rather than negative mind-states and behaviours are more likely to be motivated to prepare for the future (Hofstede et al., 2010; Montero-Marin et al., 2018). Therefore, East-Asians are more likely to have greater levels of self-compassion and lower levels of self-coldness compared to Westerners.

Interestingly, individualistic and collectivistic cultural values had a different pattern of links with self-compassion and self-coldness across Ireland and China. In Irish sample, HI was associated with greater self-compassion, and VC was associated with greater self-coldness. It may be that cultural values at the individual level that are more in line with the mainstream values in a particular cultural context may result in greater self-compassion, whereas cultural values at the individual level that are contrary to the mainstream values in a particular cultural context may cause more cognitive dissonance and lead to greater self-coldness. However, those relationships were more complicated in China since most of cultural values

measured in this study were positively correlated with self-compassion and self-coldness. The complicated results were similar to the findings in a study of Neff et al. (2008) that both independent and interdependent self-construals were associated with the positive and negative components of the SCS. Zhao et al. (2021) investigated how Chinese individuals understand the positive and negative components of the SCS. They found that Chinese individuals reported both positive and negative views for each component, which diverged from the polarized positive and negative components in original conceptualization of self-compassion that presented by (Neff, 2003b). This might be explained by the dialectical thinking style in East-Asians (Peng & Nisbett, 1999; Zhang et al., 2015). Peng and Nisbett (1999) examined the reactions of Chinese and Americans to two apparently contradictory statements, finding that American individuals tended to make a polarized choice – they believed that one statement was right and the other was wrong, while Chinese individuals tended to believe both statements might be right to some extent. This dialectical thinking style is also reflected in the attitude towards the "self", compared to individuals in the West that emphasizes internal consistency, East-Asians are more likely to tolerate internal inconsistency such as the simultaneous existence of two contradictory values or attitudes towards the "self" (Boyraz et al., 2019; Chen et al., 2018; Spencer-Rodgers et al., 2004, 2009). Hence, we attempt to provide potential interpretations for the complex results of the Chinese sample in the present study, considering the dialectical thinking style of Chinese individuals. In the Chinese cultural context that values group harmony and social hierarchy, individuals who adhere to mainstream cultural values (i.e., VC) are more likely to

embed the concept of the "self" in the group and may regard those with higher status as "caregivers" in the group (Hwang, 1987; Jin et al., 2021; Zhong et al., 2006), leading to greater compassion towards themselves. However, those who accept hierarchy may also experience more self-judgment when they fail to meet the expectations of the social hierarchy (Kitayama et al., 1997; Markus & Kitayama, 1991; Zhao et al., 2021), regardless of whether they focus on individual achievements (i.e., VI) or group goals (i.e., VC). Despite Chinese individuals who value group harmony and equality (i.e., HC) may generate more self-compassion due to receiving mutual assistance and support within the group, they may also feel that they are not fulfilling their role in the group when their personal needs conflict with the group goals (Markus & Kitayama, 1991; Triandis & Suh, 2002), which may result in greater self-judgment and feelings of isolation. Additionally, Chinese individuals who value equality and self-focus (i.e., HI) may experience cognitive dissonance due to the conflict between their cultural values at the individual level and the mainstream values in the cultural context of China, which may lead to greater self-coldness (Arimitsu, 2023; Yamaguchi et al., 2014). However, they may also practice more self-compassion through self-care and avoiding hierarchical competition. Therefore, it is possible that a cultural value leads to both self-compassion and self-coldness in East Asia but not in the West, as shown in our results. Our findings suggested that Chinese individuals may view the relationship between personal needs and group goals in a more dialectical way (Chio et al., 2021; Peng et al., 2006; Zhao et al., 2021), which may lead to a more complex view of the "self" compared to Irish individuals.

This is the first study to explore how alexithymia interacts with cultural values (HC, VC, HI, VI) to influence self-compassion and self-coldness. A key claim of the attention-appraisal model of alexithymia (Preece et al., 2017) and the process model of emotion regulation (Gross, 2015) is that alexithymia impairs emotion regulation (Luminet & Zamariola, 2018; Preece et al., 2017; Preece et al., 2023). In the attention-appraisal model of alexithymia (Preece et al., 2017), the concept of alexithymia is integrated into the widely accepted process model of emotion regulation (Gross, 2015), suggesting that emotions can be processed and regulated through a four-stage system (situation-attention-appraisal-response) and alexithymia might impair this system (Preece et al., 2023). Adaptive emotion regulation requires applying the appropriate strategies depending on the context (Aldao et al., 2015; Sheppes et al., 2011), whereas alexithymia impairs the capacity to attend to and appraise emotions, resulting in inadequate information to guide subsequent decisions regarding the use of emotion regulation strategies (Gross, 2015; Sheppes et al., 2011). Our findings revealed that the impairment of alexithymia on emotion regulation might be weakened by individualistic cultural values. By emphasizing self-focus, individualistic cultural values at the individual level may strengthen self-compassion and weaken self-coldness in individuals with higher alexithymia, while specific aspects of individualism (such as equality or competition) may function differently depending on the cultural context. In the Chinese sample, we found that more endorsement of HI enhanced self-compassion in individuals with higher alexithymia. In the cultural context of China which emphasizes hierarchy, individuals endorse more HI may regard equality and self-

focus as an alternative value system at the individual level. HI emphasizes autonomy and equality, which encourages people to prioritize their personal emotional needs even in the hierarchical social environment (Singelis et al., 1995; Triandis & Gelfand, 1998). Therefore, Chinese individuals with higher alexithymia might benefit from more endorsement in HI to mitigate their emotional awareness deficits and foster self-compassion through self-care. Furthermore, in the Irish sample, the vertical aspect of individualism (VI) was found to enhance self-compassion and weaken self-coldness among individuals with higher alexithymia. The possible interpretation is that the emphasis on equality at the national level in Ireland may create a social environment in which the competition at the individual level may focus more on personal growth and self-improvement, rather than oppressive hierarchical competition. In this cultural context, VI may lead to more goal-oriented performance stress than interpersonal stress. Previous studies have found that individuals with higher alexithymia are more likely to rely on emotional detachment to cope with stress, such as reducing or avoiding emotional experiences (Brewer et al., 2016; Coriale et al., 2012; Panayiotou et al., 2015). Although emotional detachment is often regarded as an emotional awareness deficit (Taylor et al., 1999), VI cultural value at the individual level may provide a self-improvement goal in the social environment of Ireland, which may help individuals with higher alexithymia focus more on goal-oriented behaviours than emotional distress, fostering self-compassion as a way to recover from performance stress (Wong & Mak, 2013). Moreover, the emotional detachment may help individuals with higher alexithymia avoid overly internalizing failures and self-criticism, thereby weakening self-

coldness. Additionally, in Chinese sample, more endorsement in VC enhanced self-coldness in individuals with higher alexithymia. The hierarchical collectivistic cultural context of China emphasizes obedience to group goals and acceptance of hierarchy (Singelis et al., 1995; Triandis & Gelfand, 1998). VC cultural values at the individual level further strengthen the recognition of these cultural norms. Previous research suggested that more endorsement of Asian cultural values might exacerbate self-judgement and self-criticism in individuals with poor emotion regulation ability, since these individuals are more likely to misinterpret the hierarchical norms of society as personal failures and less likely to seek professional help (Markus & Kitayama, 1991; Wong et al., 2010). For individuals with higher alexithymia who have difficulty in identifying and processing emotions (Taylor et al., 1999), this misinterpretation may lead to greater emotional distress when facing interpersonal stress, thereby exacerbating self-coldness. It is worth noting that, all the interaction effects found in the present study were marginal, it would be beneficial if future research could further explore the robustness of these findings.

The current study did not observe gender difference in alexithymia, which is inconsistent with a recent meta-analysis that reported higher levels of alexithymia in male than female, however this was only with a small effect size (Mendia et al., 2024). Mendia et al. (2024) suggested that cultural factors might play a role in explaining the observed gender differences, given that the meta-analysis included a wide range of countries. They suggested masculinity-femininity, instead of individualism-collectivism, may be able to explain the observed gender differences in alexithymia, which has been supported in previous studies (Basabe et al., 2002;

Levant & Wong, 2013). Masculinity-femininity is a dimension in the popular cultural model of Hofstede et al., (2010), which has been renamed as Motivation towards Achievement and Success (Hofstede, 2023). Specifically, Mendia et al. (2024) suggested that gender differences in alexithymia are more likely to be observed in feminize cultures (e.g., Sweden) that value emotional identification and experiences since women are expected to provide emotional support, whereas gender differences might be reduced in masculine cultures (e.g., Japan) that focus more on success and performance than emotions, as similar emotional norms are applied to both genders (Basabe et al., 2002; Fischer et al., 2013; Levant, 1992). In the cultural model of Hofstede et al., (2010), the nation-level masculinity scores in Ireland and China are similar and relatively high (Ireland = 68, China = 66). This may lead to similar levels of emotional awareness across genders, which may interpret the similar levels of alexithymia between male and female in our sample.

Limitations

The present study has a few limitations which need to be addressed in future research. Firstly, although efforts were made to measure cultural values at the individual level, we have to acknowledge that not all subscales of the INDCOL showed satisfactory internal consistency in the present study, although reliability and validity of this scale was supported by a former analysis that involved multiple countries in a large dataset (Fatehi et al., 2020). This is not surprising because whether culture can be quantified by self-report questionnaire is highly controversial due to the complicated essence of culture, and the reliability and validity of existing

culture measurement instruments has been disputable in the field of cross-cultural psychology (Taras et al., 2009). Accordingly, attention should be paid when explaining cultural values relevant results of the current study. However, we still believe it is an innovation of the current research that assessing cultural values at the individual level rather than relying on national cultural scores like what most cross-cultural studies did. Secondly, this study only examined one Western country and one East-Asian country, thus we cannot guarantee that our results can be generalized to all East-Asian or Western countries. Given that cultural research on the relationship between alexithymia and emotion regulation remains in its infancy, it would be beneficial if future research could expand this exploration to different cultural contexts. Finally, we acknowledge the existence of broader cultural values in addition to individualism and collectivism, which need to be focused on in future research. For instance, there is another dimension named Long/Short-Term Orientation (LTO-STO) in the model of Hofstede et al. (2010), which refers to whether future rewards or immediate gratification are being prioritized. Montero-Marin and his colleagues (2018) found that self-compassion is positively related to long-term orientation. Individuals from cultures that value long-term orientation may view self-compassion as an investment in long-term emotional health, thus using it more frequently, whereas those from cultures that value short-term orientation might prioritize more immediate strategies such as distracting from negative emotional stimuli (Hofstede, 2023; Hofstede et al., 2010; Montero-Marin et al., 2018). Future studies could consider this cultural dimension when exploring how self-compassion functions across cultures.

Conclusion

Altogether, the present study indicates the understanding of the two-factor construct of the Self-Compassion Scale may be influenced by culture. Moreover, this study contributes preliminary evidence to the role alexithymia in cross-cultural self-compassion and self-coldness. Furthermore, this study highlights the necessity to consider the dynamic nature of culture in cross-cultural investigation.

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Chapter Four: Neural activation patterns during self-compassion and cognitive reappraisal are influenced by culture: An electroencephalography (EEG) study

Abstract

Self-compassion is an emotion regulation strategy which has been shown to be helpful in the West. However, few studies compared self-compassion to another emotion regulation strategies from a cross-cultural perspective. This study aimed to compare the effectiveness of self-compassion and cognitive reappraisal on mitigating negative emotions and promoting positive emotions in Ireland and China. We also explored differences in the neural activation patterns during these two strategies between the two countries. Fifty-five healthy adults (30 in China; 25 in Ireland) recalled an upsetting personal memory, then they engaged in a self-compassion or cognitive reappraisal writing exercise, during which brain activity was recorded using EEG. The levels of negative and positive emotions were self-reported before and after intervention. Whole-brain analyses were conducted for theta-, alpha-, beta-, and gamma-bands. Both self-compassion and cognitive reappraisal effectively reduced self-reported negative emotions whilst also promoted self-reported positive emotions across Ireland and China. Additionally, there were differences in the associated patterns of neural activity between each country; with greater frontal power during self-compassion in the Chinese sample but greater posterior power during cognitive reappraisal in the Irish sample. This study suggests cross-cultural effectiveness of self-compassion and cognitive reappraisal on negative

and positive emotions. Furthermore, this study revealed how culture shapes the neural activation patterns during emotion regulation, contributing to the growing field of cultural neuroscience.

Keywords: self-compassion, cognitive reappraisal, emotion, cross-culture, electroencephalography (EEG)

Outputs

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CRediT authorship contribution statement:

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Introduction

Self-compassion is an influential emotion regulation strategy developed by Neff (2003) in the West, which entails accepting one's own suffering non-judgmentally, whilst also being kind towards oneself. It is characterized by three parts: mindfulness, common humanity, and self-kindness. Existing literature suggests possessing higher levels of self-compassion is associated with a variety of benefits such as increased well-being and psychological health (Egan et al., 2022; Lou et al., 2022; Trindade & Sirois, 2021; Zessin et al., 2015). Although most research on self-compassion is based on a cross-sectional design, a longitudinal study of Stutts et al. (2018) supported the benefits of self-compassion over time on negative emotions, depression, and anxiety.

Researchers are increasingly developing self-compassion interventions; such as inducing a self-compassionate mindset through a writing exercise (Leary et al., 2007; Neff et al., 2021). The efficacy of self-compassion writing exercises has been supported in the Western cultural context in terms of relieving negative emotions (Miyagawa, 2023), depression, anxiety (Swee et al., 2023), and social stress (Burnham & Kocovski, 2024; Harwood & Kocovski, 2017). In addition, Guan and her colleagues (2021) conducted a series of studies with Chinese participants and found that online self-compassion writing exercise was effective in reducing the levels of negative emotions and anxiety. At 1-month and 3-month follow-ups, Wong and Mak (2016) found that 3-day self-compassion writing exercise effectively reduced physical symptoms among Hong Kong Chinese. The benefits of other

interventions such as compassion-focused imagery (Gilbert, 2010) and self-compassion meditations (Kirschner et al., 2019) have also been supported (see Ferrari et al., 2019; Kirby et al., 2017; Wilson et al., 2019 for reviews). However, as pointed out by a recent review (Kariyawasam et al., 2023), the lack of studies in the Asian cultural context limits the confidence of cross-cultural applicability of self-compassion interventions. Moreover, a recent systematic review involving extensive emotion regulation strategies has shown the lack of cross-cultural comparison studies across Western countries and East-Asian countries on self-compassion (Song et al., 2024).

Given that it is unclear how self-compassion compares to other emotion regulation strategies frequently used to relieve negative emotions and promote positive emotions, the current study particularly includes cognitive reappraisal, which refers to thinking about the emotion-eliciting situation in a different way to reinterpret the situation (Gross & John, 2003). There are several reasons for selecting cognitive reappraisal as the comparison strategy. Firstly, cognitive reappraisal is frequently promoted as an adaptive emotion regulation strategy and has been widely studied (Ford & Mauss, 2015; Song et al., 2024). Cognitive reappraisal has been found to be associated with reduced anxiety and negative emotions and increased positive emotions in Western cultural contexts and East-Asian cultural contexts (Blalock et al., 2016; Silvers et al., 2015; Troy et al., 2019). Given its empirically supported effectiveness, it is a valuable benchmark for exploring the extent to which self-compassion is effective. Secondly, several studies compared self-compassion and cognitive reappraisal in the Western samples and

demonstrated similar benefits for reducing negative emotions, increasing positive emotions, and reducing symptoms of social anxiety (Burnham & Kocovski, 2024; Diedrich et al., 2014; Shikatani et al., 2014; Stevenson et al., 2019). Since self-compassion is rooted in Eastern Buddhism, it is necessary to examine whether this strategy could regulate emotions similarly or even more effectively than cognitive reappraisal in East-Asian cultures. Finally, both self-compassion and cognitive reappraisal belong to the Cognitive Change stage in the most widely used process model of emotion regulation, which focuses on systematically changing the content of one's thoughts and emotions (Gross, 1998). Comparing emotion regulation strategies within the same framework allows for a more meaningful examination of the similarities and differences in neural activation patterns between them.

Previous studies have suggested the brain regions includes frontal and parietal cortices that are associated with cognitive functions would be recruited during cognitive regulation strategies (Buhle et al., 2014; Etkin et al., 2015; Luo et al., 2023; Morawetz et al., 2017; Niendam et al., 2012). Among various cognitive regulatory strategies, the neural activation patterns of cognitive reappraisal have received the most attention across cultural groups. A few neuroimaging studies have supported the recruitment of a widespread brain regions involved with cognitive reappraisal, including the prefrontal and parietal cortices (Buhle et al., 2014; Gross, 2015; Morawetz et al., 2017; Ochsner et al., 2012; Ochsner & Gross, 2005). In addition, self-compassion is a complicated cognitive regulatory process that involves multiple components, during which increased gamma power at the frontal and parietal regions has been observed in previous studies, suggesting that people may

integrate various pieces of information into a coherent cognitive process while practicing self-compassion (Berry et al., 2020; Guan et al., 2021; Kim et al., 2020; Luo et al., 2023; Lutz et al., 2004). Although most of the evidence is based on Western participants, a recent study of Luo et al. (2023) supported the integrating role of gamma oscillation at the frontal and centroparietal regions during self-compassion in Chinese participants in the context of social rejection.

Previous research has suggested that culture influences how individuals engage in emotion regulation processes, and the focus has mainly been on the comparison between Western individuals and East-Asian individuals (Ford & Mauss, 2015; Kitayama et al., 1997; Markus & Kitayama, 1991). In cultural psychology, the most frequently studied cultural values between these two cultural groups are individualism and collectivism, as suggested by the popular cultural model of Hofstede et al. (2010). Specifically, the independent self-construal that is emphasized in the individualistic cultural contexts (e.g., Ireland) tends to encourage individuals to focus on the self-relevant information in the emotion regulation processes, whereas the interdependent self-construal that is valued in the collectivistic cultural contexts (e.g., China) tends to encourage individuals to perceive and explain emotional events with reference to the link between self and others (Kitayama et al., 1997; Markus & Kitayama, 1991). Moreover, according to the same cultural model, it has been suggested that short-term orientation and long-term orientation may also be indicative of differences between Westerners and East-Asians (Hofstede et al., 2010). Specifically, individuals in cultures that emphasize short-term orientation (e.g., Ireland) tend to focus on the immediate emotional relief

during the emotion regulation processes, whereas those in cultures that emphasize long-term orientation (e.g., China) tend to consider the consequences in the future when perceiving the current emotional events (Hofstede, 2023; Hofstede et al., 2010; Montero-Marin et al., 2018; Nisbett et al., 2001). It has been suggested that culture-related characteristics may shape the neural processes associated with emotion regulation (Hampton & Varnum, 2018; Han & Ma, 2014; Knyazev et al., 2012; Qu & Telzer, 2017). More specifically, when both cultural groups are guided to apply the same emotion regulation strategy; one cultural group may engage in the emotion regulation process in a different way compared to another cultural group; which may result in different neural activation patterns even when the behavioural outcomes are similar (Knyazev et al., 2012; Qu & Telzer, 2017). Considering that Westerners tend to place a greater emphasis on the personal aspects of the self, compared to East-Asians, it is possible that Westerners show greater neural activity in posterior brain regions compared to East-Asians since these areas have been indicated to play a key role in the processing of self-related information (Knyazev, 2013; Northoff, 2016; Northoff et al., 2006) from attentional, perceptual, and mnemonic aspects during experimental tasks of accessing autobiographical memory or imagining self-related futures (Andrews-Hanna et al., 2014). A cross-cultural study by Kraus et al. (2021) found greater resting alpha power in posterior brain regions of European-Americans compared to East-Asians (Chinese and Japanese), which they found was further linked to higher levels of independent self-construal in European Americans.

Present Study

The present study aims to test the effectiveness of self-compassion and cognitive reappraisal on relieving negative emotions and promoting positive emotions in Ireland and China, as well as investigate any cultural differences in the neural activation patterns associated with these two strategies. The present research contributes to understanding the cross-cultural applicability of emotion regulation strategies and how culture shapes the neural activation patterns during emotion regulation.

It was hypothesized that both self-compassion and cognitive reappraisal will effectively reduce self-reported negative emotions and increase positive emotions in both the Irish and Chinese samples. We also hypothesized that the Irish sample would show greater power across multiple frequency bands (theta, alpha, beta, gamma) in the posterior brain regions during self-compassion and cognitive reappraisal compared to the Chinese sample.

Methods

Participants

This study recruited 56 university students from Ireland and China, those from Ireland received a voucher of €15 as participant compensation and those from China received a voucher of ¥100. One Chinese participant was excluded due to an incorrect sampling rate setup, resulting in a final dataset of 55 participants, with 25 university students living in Ireland (age: M = 23.2, SD = 3.28, range = 19–29 years; 60% Females; self-identified as 100% Whites/Caucasians), and 30 university students living in China (age: M = 23.5, SD = 1.57, range = 20–27 years; 56.67%

Females; self-identified as 100% Chinese). Data collection in both countries was approved by the local Ethics committees. All participants confirmed that they were not accessing support from mental health services. All participants gave their written informed consent before the study.

Materials and procedure

The instructions for the self-compassion writing exercise (Guan et al., 2021) and the Positive and Negative Affect Schedule (PANAS; Huang et al., 2003) used in the present study were already available in Chinese language. Additionally, the instructions for recalling an upsetting memory, the instructions for the cognitive reappraisal writing exercise, and the manipulation check items were originally in English and translated into Chinese by the first author, who is fluent in both English and Chinese. The translated materials were back-translated into English by a bilingual graduate student with formal training in translation and advanced proficiency in both languages. Both original and back-translated versions were thoroughly reviewed for accuracy and finalized after in-depth discussions between these two people.

The Irish EEG data were recorded using an actiCHamp system with 64-channel active electrodes (Brain Products, Gilching, Germany) and configured to the international 10–20 electrode system. The Chinese EEG data were recorded using Geodesic system with 64-channel active electrode system (EGI, Electrical Geodesics Incorporated, Eugene, OR, United States) and configured to the international 10–20 electrode system. To ensure good signal quality, each electrode's impedance was kept under 10 kΩ during the recording, and impedance checks were performed

before the recording and electrodes with impedance above 10 kΩ were re-adjusted for the good electrical connection between the scalp and the electrodes. For both systems, the sampling rate was 1000 Hz.

In the laboratory of both Ireland and China, participants were seated with their eyes positioned approximately 60 cm from the computer screen. The entire experiment was written in PsychoPy, and the experimenter gave verbal instructions only when the participants needed help. Written instructions were in a white font against a black background. Participants regulated the pace between tasks. After the electrode placement, EEG measurement started with participants engaging in a 10-minute resting-state which included a 5-minute eyes-closed period and a 5-min eyes-opened period where participants stared at a fixation cross in the center of the screen and relax. Next, participants were given instructions to recall a personally upsetting memory for 5 minutes and then to write down the recalled memory on paper. The effectiveness of this negative emotion induction has been demonstrated in previous studies (Hatzenbuehler et al., 2009; Kneeland et al., 2016). Then, participants were randomly assigned to either the self-compassion condition (in Ireland: $n = 14$; in China: $n = 16$) or the cognitive reappraisal condition (in Ireland: $n = 11$, in China: $n = 14$).

Those assigned to the self-compassion condition completed a self-compassion writing exercise. Self-compassion instructions were adapted from SCMI which informed participants to think about the situation in the memory "…with an attitude of acceptance and non-judgment" (part 1: mindfulness), "…as a part of being human and that you are not alone" (part 2: common humanity), and "…with

kindness to yourself" (part 3: self-kindness). For each part, participants first read the instructions, then entered a Thinking Period to apply the corresponding part of self-compassion to the recalled negative situation for three minutes while staring at a fixation cross on the screen. Following the three minutes, participants wrote down how they applied the corresponding part of self-compassion to the negative situation on a paper. For the Thinking Period, participants were instructed (written on screen and verbally) to start applying self-compassion only after pressing "space" but not before.

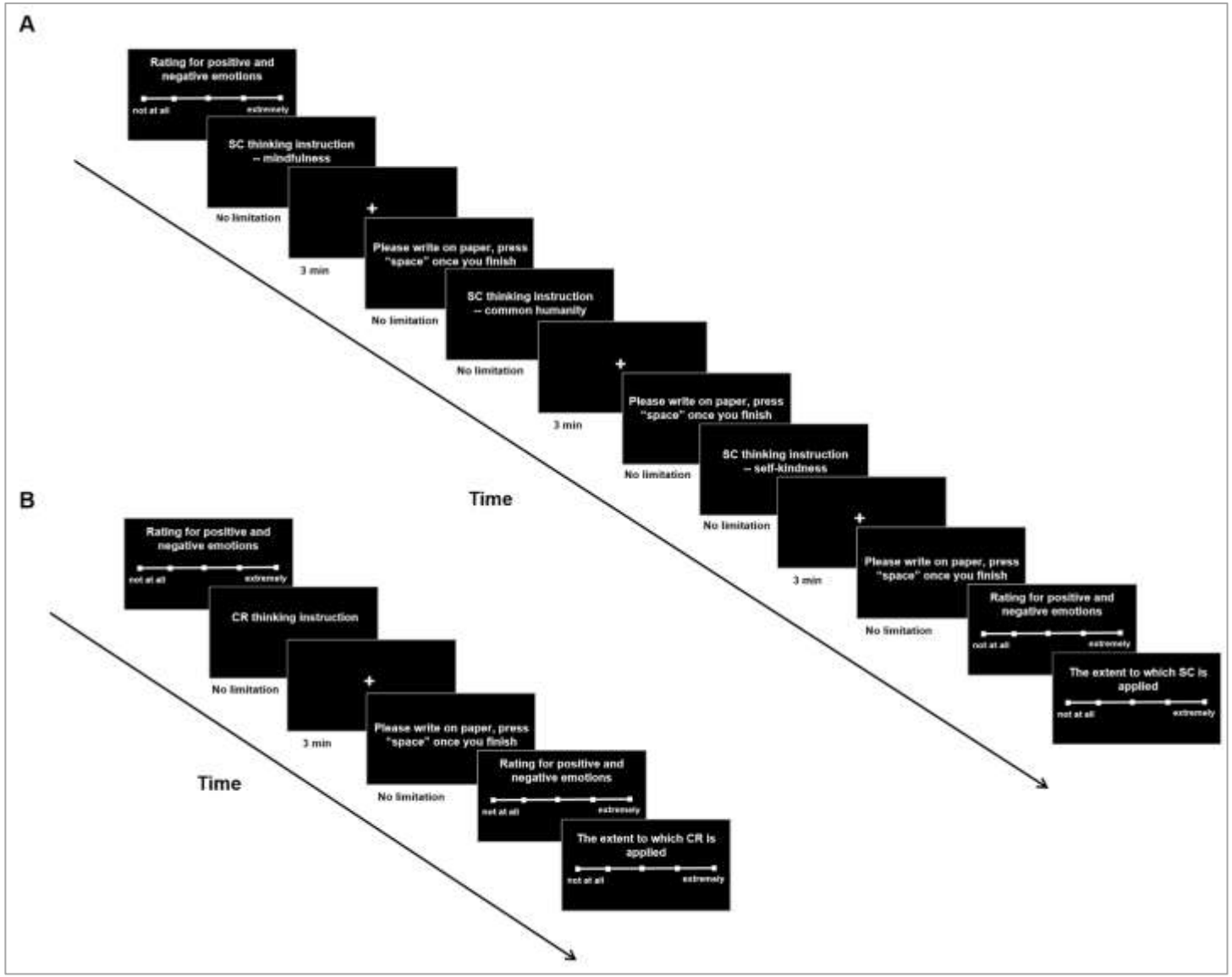
Those assigned to the cognitive reappraisal condition completed a cognitive reappraisal writing exercise. The instructions were adapted from a previous study of Fabiansson et al. (2012), which guided participants to think about the situation in a different way. Similarly, after reading the instructions, participants were instructed (written on the screen and verbally) to use cognitive reappraisal on their recalled negative situation for three minutes while staring at the cross on the screen. Following the three minutes, participants wrote down how they applied cognitive reappraisal to the negative situation on a paper. Before and after either intervention, participants completed the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) to assess their emotions 'at the moment'.

Finally, participants answered questions which measured the extent self-compassion or cognitive reappraisal is applied (manipulation check). For the self-compassion condition, manipulation check items suggested by Neff et al. (2021) were used which includes to what extent did participants "give themself the caring and tenderness they need?", "remember that there are lots of others in the world

feeling like they are?", and "keep things in perspective?". For the cognitive reappraisal condition, manipulation check items suggested by Fabiansson et al. (2012) were used which includes to what extent did participants "re-consider the event from an objective perspective?" and "consider the positive aspects of the event?". These items ranged from 1 (not at all) to 5 (extremely so). The example trials for self-compassion and cognitive reappraisal experimental sessions have been visualized in Figure 4.1.

Figure 4.1

Visualization of example trials for self-compassion and cognitive reappraisal experimental sessions.



Note. **(A)** An example trial for self-compassion experimental session. **(B)** An example trial for cognitive reappraisal experimental session. SC: the self-compassion condition; CR: the cognitive reappraisal condition

EEG Preprocessing

EEG data were imported into *MATLAB* (release 2024a, MathWorks Inc, United States), and EEG pre-processing for both Irish and Chinese samples was performed using the EEGLAB toolbox (Delorme & Makeig, 2004) and followed the same steps. Firstly, electrodes which were not common between the two caps were removed from processing, this left 51 channels for analysis (AF4, F2, Fp2, Fz, FC1, AFz, F1, Fp1, AF3, F3, F5, FC5, FC3, C1, F7, FT7, C3, CP1, C5, T7, TP7, CP5, P5, P3, P7, P1, PO3, Pz, O1, Poz, Oz, PO4, O2, P2, CP2, P4, P8, P6, CP6, TP8, C6, C4, C2, T8, FC4, FC2, FT8, FC6, F8, F6, F4). Secondly, EEG data were filtered by a 0.5-100 Hz band-pass FIR filter followed by a 48-52 Hz notch filter to eliminate line noise. Thirdly, bad channels were identified by visual inspection and were interpolated using neighbouring channels, after which EEG signals were segmented into 2s intervals and segments with artifacts (muscle, eye blinks, or eye movements) rejected by visual inspection. Fourthly, the eye blinks artifacts were minimised using independent component analysis (ICA), specifically the Infomax ICA algorithm (runica), after which segments with residual artifacts exceeding ± 100 μV (peak-to-peak) were excluded to eliminate large, sudden voltage fluctuations that are unlikely to be associated with typical brain activity. Next, all channels were re-referenced to an average electrode. Finally, baseline corrections for all task-related epochs were conducted using the first second of the eyes-opened resting state. During preprocessing, the mean duration of rejected artifacts was 22.11 seconds (SD = 16.76), with no significant differences in artifact rejection times across the four conditions ($p = 0.43$).

Statistical Analysis

Effects of self-compassion and cognitive reappraisal

In order to observe the behaviour responses, the effects of self-compassion and cognitive reappraisal on negative and positive emotions across countries were examined in *R v.4.3.0* (R Core Team, 2023). Firstly, two three-way mixed-design ANOVAs were conducted on PANAS scores for negative emotions and PANAS scores for positive emotions, with Country (Ireland and China) and Emotion Regulation Strategy (self-compassion and cognitive reappraisal) as the between-subject factors, and Time as the within-subject factor (pre-intervention and post-intervention).

Spectral power analysis

The three-minute thinking periods were the epochs of interest for the EEG data. For self-compassion, only the third thinking period was analyzed as it was assumed to be a culmination of all three portions of the self-compassion strategy.

Spectral power analysis was performed using the Multitaper method from the FieldTrip toolbox (Oostenveld et al., 2011), with a frequency-dependent Hanning window for reducing spectral leakage, within a frequency range of 0.5 Hz to 100 Hz. For each epoch, a Fast Fourier Transform (FFT) method was applied to obtain spectral power (μV^2). Then, Power Spectral Density (PSD) values ($\mu V^2/Hz$) were calculated by averaging spectral power within each frequency band across time. In this study, we averaged spectral power across time in order to capture the general neural activation patterns during the 3-minute emotion regulation tasks.

The cluster-based permutation test implemented in the FieldTrip toolbox was

extended to a 2x2 between-subjects ANOVA, with Country (Ireland and China) and Emotion Regulation Strategy (self-compassion and cognitive reappraisal) and performed for whole brain in theta (4-8 Hz), alpha (8-12 Hz), beta (13-25 Hz), and gamma (30-60 Hz) bands, with a cluster alpha set at 0.05 (Chan et al., 2021). Further analysis by post-hoc t-tests were used to make pairwise comparisons in the case of significant differences. The Monte Carlo method was employed to generate 500 permutations, and a threshold for the significant difference in power was set at 0.025 (two-tailed).

Results

Effects of emotion regulation on negative and positive emotions

A three-way mixed-design ANOVA on PANAS scores for negative emotions with Country (Ireland and China) and Emotion Regulation Strategy (self-compassion and cognitive reappraisal) as the between-subject factors, and Time as the within-subject factor (pre-test and post-test) was conducted. There was a significant main effect of Time [$F(1,51) = 76.15$, $\eta_g^2 = 0.22$, $p < 0.001$]. Specifically, participants reported significantly lower negative emotions after the emotion regulation intervention ($M = 15.64$, $SD = 6.84$) compared to before the intervention [$M = 24.44$, $SD = 9.48$, $t(51) = 8.73$, $p < .001$]. There was no main effect of Emotion Regulation Strategy or Country. There was a significant interaction between Emotion Regulation Strategy and Time [$F(1,51) = 6.83$, $\eta_g^2 = 0.25$, $p = 0.012$], suggesting that the negative emotions rating varies depending on whether participants applied self-compassion or cognitive reappraisal. Specifically, participants who applied self-

compassion reported a significant reduction in negative emotions from pre-test (M = 25.97, SD = 9.38) to post-test [M = 14.80, SD = 4.59, $t(51) = 8.43$, $p < .001$], while participants who applied cognitive reappraisal reported a significant but relatively small reduction in negative emotions [pre-test: M = 22.60, SD = 9.46, post-test: M = 16.64, SD = 8.82, $t(51) = 4.13$, $p < .001$] (see Table 4.1). No other significant interactions were observed.

Table 4.1

Mean negative emotions ratings and standard deviations.

	Negative Emotions Ratings			
	Pre		Post	
	M	*SD*	*M*	*SD*
Ireland (SC)	27.50	9.74	14.79	3.77
Ireland (CR)	21.55	8.55	14.55	3.50
China (SC)	24.62	9.16	14.81	5.33
China (CR)	23.43	10.35	18.29	11.30

Note. SC: the self-compassion condition; CR: the cognitive reappraisal condition; Pre: emotional ratings before particular emotion regulation intervention; Post: emotional ratings after particular emotion regulation intervention

A three-way mixed-design ANOVA on PANAS scores for positive emotions with Country (Ireland and China) and Emotion Regulation Strategy (self-compassion and cognitive reappraisal) as the between-subject factors, and Time as the within-subject factor (pre-test and post-test) as conducted. There was a significant main effect of Time [$F(1,51) = 48.42$, $\eta_g^2 = 0.22$, $p < 0.001$]. Participants reported significantly higher positive emotions after the emotion regulation intervention (M = 29.76, SD = 8.62) compared to before the intervention [M = 21.87, SD = 6.24, $t(51)$ = -6.96, $p < .001$] (see Table 4.2 for specific results), regardless of Country and Emotion Regulation Strategy. There was no main effect of Country or Emotion

Regulation Strategy. There were no significant interactions.

Table 4.2

Mean positive emotions ratings and standard deviations.

	Positive Emotions Ratings			
	Pre		Post	
	M	*SD*	*M*	*SD*
Ireland (SC)	21.93	5.50	30.29	7.39
Ireland (CR)	18.91	4.81	27.27	8.56
China (SC)	21.75	6.66	32.19	10.09
China (CR)	24.29	6.98	28.43	8.08

Note. SC: the self-compassion condition; CR: the cognitive reappraisal condition; Pre: emotional ratings before particular emotion regulation intervention; Post: emotional ratings after particular emotion regulation intervention.

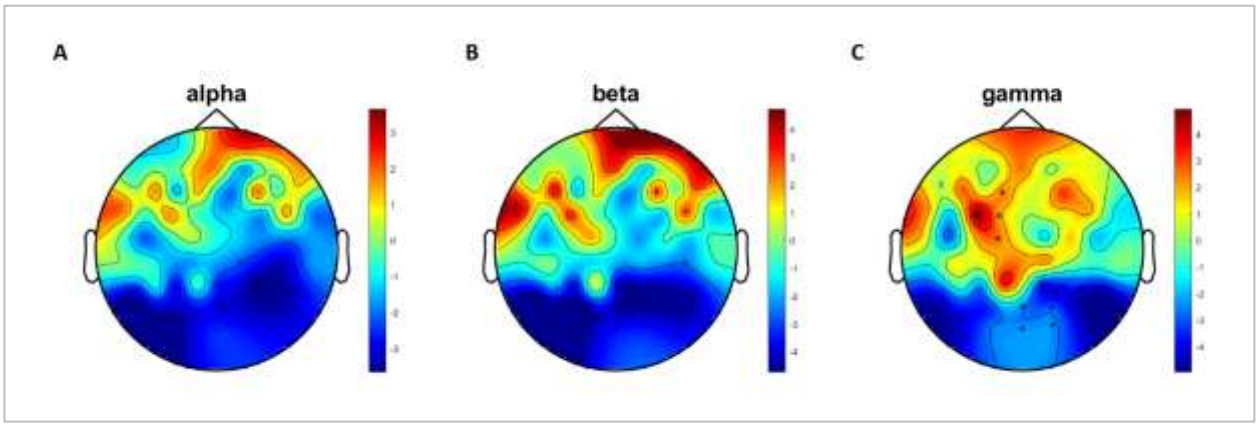
Effects of emotion regulation on EEG powers

Four separate two-way ANOVAs were conducted for theta-, alpha-, beta-, and gamma-bands on PSD values, with Country (Ireland and China) and Emotion Regulation Strategy (self-compassion and cognitive reappraisal) as the between-subject factors. There were main effects of Country on PSD values in each of the alpha-, beta-, and gamma-band analyses, but not in the theta band analyses (see Figure 4.2). There was greater alpha power in the Irish sample compared to the Chinese sample ($p < 0.02$) in the posterior regions (significant at Pz, Oz, O2, P4, P8, CP6, CP2, POz, PO4, P6, P2). There was greater beta power in the Irish sample compared to the Chinese sample ($p < 0.02$) in posterior regions (significant at Pz, P3, O1, Oz, O2, P4, P8, CP6, P5, PO3, POz, PO4, P6, P2), greater gamma power in the Irish sample compared to the Chinese sample ($p < 0.01$) in parietal and occipital sensors (Oz, O2, P4, POz, PO4, P6, P2), and greater gamma power in the Chinese sample compared to the Irish sample ($p < 0.01$) in frontal areas (significant at FC1,

F1, FC3, C1). There was no main effect of Emotion Regulation Strategy. Additionally, significant interactions between Emotion Regulation Strategy and Country were observed in the alpha, beta, and gamma bands ($p < 0.05$), but not in the theta band. To further locate these interactions, independent samples of t-tests were conducted as post-hoc analyses, and the specific regions and statistical details were reported below.

Figure 4.2

Main effects of Country on PSD values across frequency bands



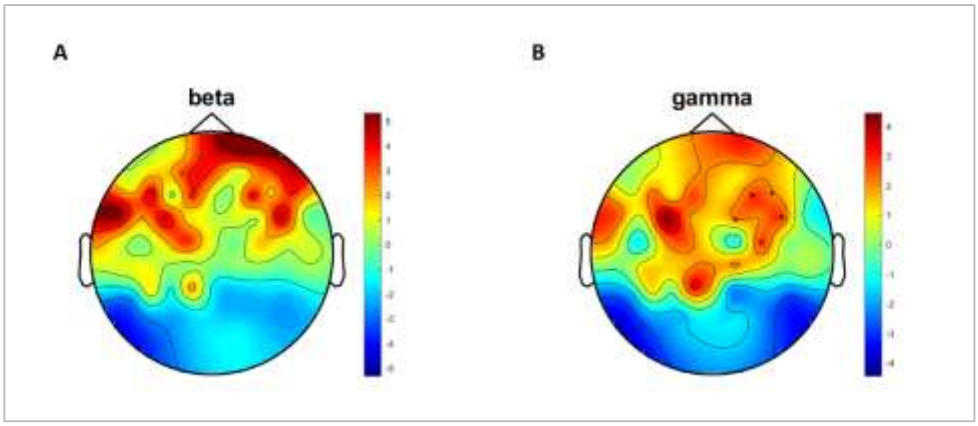
Visualization of EEG statistical main effect. Red areas indicate greater PSD value in China compared to Ireland, blue areas indicate lower PSD value in China compared to Ireland. Asterisk (*): clusters with p (cluster alpha) < 0.01; "x": clusters with p (cluster alpha) < 0.05. Colour bars represent t-values. **(A)** The topography for the alpha band. **(B)** The topography for the beta band. **(C)** The topography for the gamma band.

Self-Compassion

The topographies of the results of post-hoc t-test for self-compassion can be found in Figure 4.3. Specifically, cluster-based permutation tests indicated greater beta power in the Chinese sample compared to the Irish sample ($p < 0.02$) in left-frontal areas (significant at FC5, AF3, F1, F5, FT7, FC3), and greater gamma power in the Chinese sample compared to the Irish sample was observed ($p < 0.01$) in right-frontal areas (significant at C4, FC6, FC2, F4, F6).

Figure 4.3

Effects of self-compassion on PSD values across frequency bands



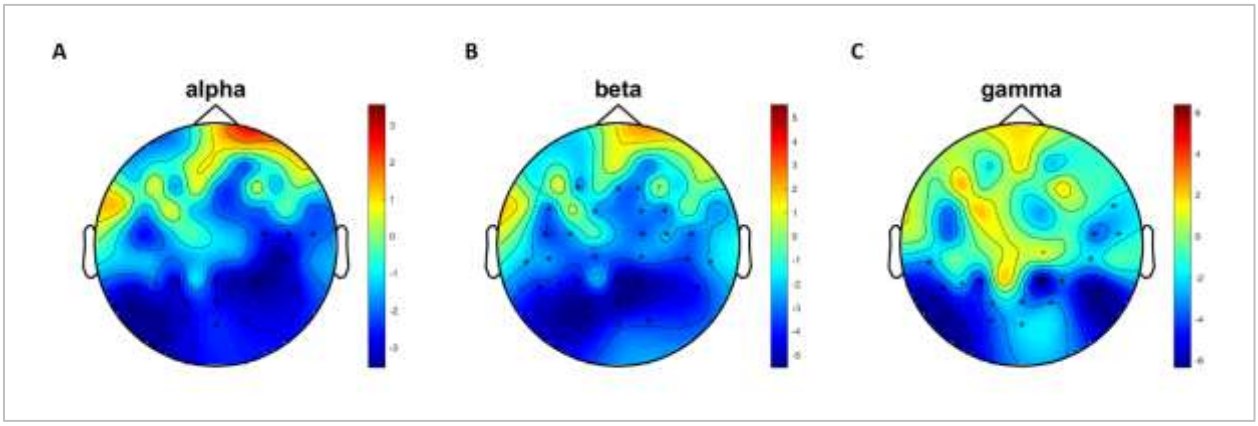
Visualization of EEG statistical effect of self-compassion. Red areas indicate greater PSD value in China compared to Ireland, blue areas indicate lower PSD value in China compared to Ireland. Asterisk (*): clusters with *p* (cluster alpha) < 0.01; "x": clusters with *p* (cluster alpha) < 0.05. Colour bars represent t-values. **(A)** The topography for the alpha band. **(B)** The topography for the beta band. **(C)** The topography for the gamma band.

Cognitive Reappraisal

The topographies of the post-hoc t-test for cognitive reappraisal can be found in Figure 4.4. Cluster-based permutation tests indicated greater alpha power in the Irish sample compared to the Chinese sample ($p < 0.05$) in posterior regions (significant at Pz, P3, O1, Oz, O2, P4, P8, CP6, C4, T8, P5, PO3, POz, PO4, P6, P2, C6); also greater beta power in the Irish sample compared to the Chinese sample ($p < 0.05$) in broader frontal and centroparietal regions (significant at Fz, F3, FC5, FC1, C3, CP5, CP1, Pz, P3, P7, O1, Oz, O2, P4, P8, CP6, CP2, C4, FC2, C5, TP7, P5, PO3, POz, PO4, P6, P2, TP8, C6, C2, FC4, F2); and greater gamma power in the Irish sample compared to the Chinese samples ($p < 0.05$) mainly in parietal regions (significant at P3, P7, O1, Oz, P4, P8, CP6, T8, TP7, P5, PO3, POz, PO4, P6, P2, C6, FT8).

Figure 4.4

Effects of cognitive reappraisal on PSD values across frequency bands



Visualization of EEG statistical effect of cognitive reappraisal. Red areas indicate greater PSD value in China compared to Ireland, blue areas indicate lower PSD value in China compared to Ireland. Asterisk (*): clusters with p (cluster alpha) < 0.01; "x": clusters with p (cluster alpha) < 0.05. Colour bars represent t-values. **(A)** The topography for the alpha band. **(B)** The topography for the beta band. **(C)** The topography for the gamma band.

Manipulation check

Two independent-sample t-tests were conducted to examine the effect of Country (Ireland and China) on the extent to which participants self-reported applying self-compassion and cognitive reappraisal. Regarding self-compassion condition, Chinese participants (M = 4.23, SD = 0.58) reported applying slightly greater self-compassion compared to Irish participants (M = 3.42, SD = 1.00, p = 0.02). Regarding cognitive reappraisal condition, Chinese participants (M = 3.43, SD = 0.87) reported applying similar extent of cognitive reappraisal compared to the Irish sample (M = 3.42, SD = 1.00, p = 0.59).

Discussion

Our findings support both cognitive reappraisal and self-compassion are generally effective in relieving negative emotions and promoting positive emotions across cultural groups, which is consistent with previous research on the universal

and applicable efficacy of these two cognitive regulatory strategies (Ferrari et al., 2019; Ford & Mauss, 2015; Kalibatseva, 2016; Kariyawasam et al., 2023). Numerous studies have demonstrated cognitive reappraisal is effective in reducing emotional distress (e.g., negative emotions, depression, anxiety, and stress) and also increasing life satisfaction and well-being across Western and East-Asian cultures (Ford & Mauss, 2015; He et al., 2021; Kalibatseva, 2016). Additionally, the applicability of various self-compassion interventions has been empirically supported across cultural groups in previous research (see Ferrari et al., 2019; Kariyawasam et al., 2023; Kirby et al., 2017 for reviews).

Regarding self-compassion writing interventions, the benefits have been supported in the Western samples in terms of reducing negative emotions and social stress (Burnham & Kocovski, 2024; Harwood & Kocovski, 2017; Miyagawa, 2023). Moreover, the study of Wong and Mak (2016) first examined self-compassion writing exercise in Hong Kong Chinese. They demonstrated the efficacy of a self-compassion writing exercise in Hong Kong Chinese in terms of reducing negative emotions and physical symptoms such as constant fatigue and poor appetite, but there were no significant improvements in the level of depression. A recent study of Guan, et al. (2021) supported the benefits of the SCMI (writing exercise used in the present study) on reducing the levels of negative emotions and anxiety in Chinese participants. In addition to writing exercises, the benefits of other self-compassion interventions were also supported across Western and East-Asian cultures. For example, Huang and her colleagues (2021) conducted a 4-week intervention adapted from multiple interventions, which have been developed and demonstrated for their

efficacy in the West, includes Mindfulness-Based Cognitive Therapy (Segal et al., 2012), Compassionate Mind Training (Gilbert & Procter, 2006), and the Mindful Self-Compassion Program (Germer & Neff, 2019), and observed the benefits for Chinese college students in terms of promoting future-oriented coping whilst also reducing depression and stress.

The present study found that self-compassion was more effective in reducing negative emotions than cognitive reappraisal across the Irish and Chinese samples, despite their similar efficacy at promoting positive emotions. Our findings are inconsistent with previous research that supported similar efficacy of these two strategies in relieving negative emotions (Burnham & Kocovski, 2024; Shikatani et al., 2014). It has been suggested that the effectiveness of a particular emotion regulation strategy may vary depending on the situation in which it is employed (Aldao, 2013; Aldao & Nolen-Hoeksema, 2012). Unlike Burnham and Kocovski (2024) and Shikatani et al. (2014) that employed self-compassion and cognitive reappraisal in a past social situation, the present study employed these two strategies in the situation of a personal upsetting memory without limiting it to a social situation. In order to minimize participants' concerns about confidentiality and anonymity, we did not collect specific personal upsetting memories. In future research, it may be worthwhile to explore which specific situation of self-compassion is more effective when compared to cognitive reappraisal. Notably, methodological differences between self-compassion and cognitive reappraisal interventions may help explain these findings. Specifically, the self-compassion intervention involved three separate parts: mindfulness, common humanity, and self-

kindness, whereas the cognitive reappraisal intervention involved a single task of objectively restructuring the personal upset memory. Given this methodological difference, there might be a dose-response relationship, suggesting that the greater efficacy of self-compassion in relieving negative emotions compared to cognitive reappraisal in the present study may be partially due to the cumulative effect of self-compassion's three parts. Future research could explore the contribution of each part of self-compassion to better understand their individual effects.

This study further suggests that culture impacts the neural activation patterns during emotion regulation. The Irish sample showed greater posterior power during cognitive reappraisal compared to the Chinese sample, while the Chinese sample showed greater frontal power during self-compassion. Our findings suggest that different cultural groups may engage in the particular emotion regulation strategy through divergent thought processes, resulting in different neural pathways even when the behavioural benefits are similar (Chiao et al., 2013; Han & Ma, 2014; Kitayama & Uskul, 2011).

However, due to the lack of direct behavioural evidence such as participants' written contents (in order to minimize their concerns about confidentiality and anonymity), self-reported cultural values, or qualitative interviews, we were unable to determine the specific thought processes that underlie the different neural activation patterns we observed between the two cultural groups. Future studies may wish to consider involving cultural measurement, open-ended questions or interviews in the experimental design to better understand participants' thought focus during emotion regulation. For example, according to the latest updated

nation-level scores in the popular cultural model of Hofstede (2023), relatively high individualism (Ireland: score = 58) suggests that individuals are more likely to hold independent self-construal, whereas relatively low individualism (China: score = 43) indicates that individuals are more likely to hold interdependent self-construal (Ford & Mauss, 2015; Kitayama et al., 1997; Markus & Kitayama, 1991). Therefore, the repeated participation in the cultural practices of independence may lead Irish individuals thinking about more self-focused information during emotion regulation, whereas the repeated participation in the cultural practices of interdependence may lead Chinese individuals linking the self with the surrounding contextual information (Ford & Mauss, 2015; Kitayama & Uskul, 2011; Markus & Kitayama, 1991). Another cultural dimension in the Hofstede's model named Long/Short-term Orientation (Hofstede, 2023) may also contribute to the understanding of differences in thought processes during emotion regulation. Relatively long-term orientation in China (score = 77) compared to Ireland (score = 51) indicates that Chinese individuals are more likely to link current behaviours with future consequences, such as thinking about how their way of treating personal suffering will affect their future-oriented growth, while Irish individuals are more likely to emphasize immediately effective emotion regulation (Hofstede, 2023; Hofstede et al., 2010; Montero-Marin et al., 2018). Due to the dynamic nature of culture and the variability within cultural groups (Causadias et al., 2018; Kashima, 2016; Kashima et al., 2019), further measurements of cultural factors at the individual level are needed as behavioural evidence in future research.

Limitations

One limitation of the current study is the lack of a direct measure of cultural factors, which limits the interpretation of the observed differences between the two samples. Since culture is a dynamic system, with individuals within a society potentially endorsing diverse cultural values (Causadias et al., 2018; Kashima, 2016; Kashima et al., 2019), measuring culture at the individual level would enhance the understanding of how cultural factors impact emotion regulation processes. Additionally, in this study, we were unable to include the writing parts into the spectral power analysis due to excessive movement artefacts in the EEG signals. Thus, we cannot link neural findings with the changes of emotions before and after interventions, since we cannot distinguish whether the changes were caused by thinking or writing. Nevertheless, this study still provides valuable insights for both neural activation patterns and behavioural effects of emotion regulation across cultural groups. Furthermore, in this study, participants were guided to apply a particular strategy which is similar to most of the existing emotion regulation studies. However, in everyday life, people are more likely to flexibly employ multiple strategies and receive no specific instruction (Bonanno & Burton, 2013). A study of Baur et al. (2015) has supported the efficacy of such emotion regulation by only providing participants with generic instructions and giving them freedom to use whatever emotion regulation strategies they wished. Therefore, it would be beneficial for future studies to improve flexibility in choosing different strategies.

Conclusion

Taken together, the present EEG study indicates greater posterior activation during cognitive reappraisal and less frontal activation during self-compassion in Irish than in Chinese adults, suggesting that culture shapes the neural pathways individuals engage in the particular emotion regulation process, which contributes to the growing field of cultural neuroscience. In addition, this study demonstrated both self-compassion and cognitive reappraisal can effectively relieve negative emotions and promote positive emotions across Ireland and China, reinforcing the universal and applicable efficacy of these strategies.

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Chapter Five: General Discussion

In the opening chapter of this thesis, the lack of cultural diversity in the research sample in psychological research was discussed and I accordingly raised the important question of *whether* the existing accepted ideas about emotion regulation are universally applicable across cultural groups. In order to answer this question, three large cross-cultural empirical studies were conducted to explore how culture shapes emotion regulation in terms of regulatory frequency, behavioural outcomes, and neural activation patterns. This PhD work contributes insights to the field of emotion regulation and cross-culture through both primary empirical studies and the synthesis of available literature.

Key Findings and Contributions

Culture Shapes Emotion Regulatory Frequency

One primary contribution of this PhD work is to demonstrate culture impacts the spontaneous use frequency of emotion regulation strategies, as well as informs the most needed empirical research in the field of cross-cultural emotion regulation. The synthesis of evidence from Chapter Two found more spontaneous use of suppression and avoidance in East-Asians compared to Westerners. Repeated participation in particular cultural practices affect the spontaneous use of emotion regulation strategies (Ford & Mauss, 2015; Kitayama et al., 1997; Markus & Kitayama, 1991). In the collectivistic cultural contexts of East Asia, people are encouraged to repeatedly engage in social practices related to interdependence, resulting in more frequent behaviours that control or minimize their emotions (e.g.,

suppression, avoidance) in order to maintain interpersonal harmony within the group (Butler et al., 2007; Ford & Mauss, 2015; Markus & Kitayama, 1991; Mesquita, 2001). Instead, in the individualistic cultural contexts of the West, suppressing or avoiding emotions spontaneously is less likely to occur since such behaviours contradict social practices of independence that encourage the pursuit of personal authentic emotions (Butler et al., 2007; Soto et al., 2011). Interestingly, the cultural differences of suppression usage based on the synthesis of evidence in Chapter Two are in line with the findings of a previous systematic review that East-Asian migrants use more suppression compared to European Americans (Weiss et al., 2022). This raises the interesting possibility that East-Asian migrants are more likely to resemble East-Asians even if they have been exposed to Western culture for a long time. However, it is needed to further investigate, especially considering how much they identify with and engage in particular cultural practices.

In addition, we found no cultural difference in the use of reappraisal and rumination. A possibility is that differences in the use of emotion regulation strategies between Westerners and East-Asians mainly focus on the "display rule" in the interactions with others, rather than internal cognitive processes (Butler et al., 2007; Schunk et al., 2021). Acceptance is another internal cognitive regulation strategy that may show no cultural differences, but is understudied in existing cross-cultural comparisons, so future research is needed. Although self-compassion and mindfulness (a component of self-compassion) also belong to cognitive regulation strategies, they are rooted in Eastern Buddhism and are growing in the West as a new way of emotion regulation (Neff, 2003a; Neff et al., 2008). Thus, these two

strategies may be used more often in East Asia than in the West. It is worth noting that, although our meta-analysis found no cultural differences in the use of expression, distinct patterns associated with positive and negative emotional expression appear to exist in individual studies. It seems that Westerners are more likely to express positive emotions compared to East-Asians, and they tend to report similar expression for negative emotions. Tsai and her colleagues (2006) have suggested that East-Asians tend to value more low-arousal positive emotional states (e.g., calm and peacefulness), whereas Westerners tend to value high-arousal positive emotional states (e.g., excitement and enthusiasm), thereby Westerners are more likely to maximize positive emotions and minimize negative emotions. Expression for positive emotions may be socially appropriate in individualistic cultures since it can mobilize energy to influence the environment (Kitayama et al., 2000; Miyamoto & Ma, 2011). The preference for low-arousal emotional states may also lead to more use of distraction in East-Asians compared with Westerners (Schunk et al, 2022), whereas some studies suggested that Westerners, who endorse short-term orientation, are more likely to distract attention away from negative emotional stimuli for pursuing the immediate emotional relief (Hofstede, 2023; Hofstede et al., 2010; Montero-Marin et al., 2018; Nisbett et al., 2001). Given the lack of cross-cultural comparisons on this strategy, further empirical evidence would be beneficial.

Informed by the systematic review and meta-analysis, this PhD work (Chapter Three and Chapter Four) further focused on self-compassion as it is one of the four understudied emotion regulation strategies (self-compassion, acceptance,

distraction, and mindfulness) in the literature. By taking the Self-Compassion Scale (SCS; Neff, 2003) as a two-factor construct with self-compassion and self-coldness serving as two independent variables, the cross-sectional survey study outlined in Chapter Three indicated that the Chinese sample tend to spontaneously use more self-compassion and less self-coldness compared to the Irish sample. Due to the concept of self-compassion is derived from Eastern Buddhism, the greater exposure to Buddhist traditions may have influenced people living in China to frequently engage themselves with self-compassion practices in everyday life more than those living in Ireland. Moreover, according to the cultural model by Hofstede (2023), China is a culture that values a more long-term orientation than Ireland (China score = 77, Ireland score = 51). Since Chinese people expect rewards in the future, they may be more likely to practice positive attitudes and behaviours (e.g., self-compassion) rather than negative ones (e.g., self-coldness).

Furthermore, it appears that the use frequency of self-compassion and self-coldness may be influenced by the interactions between cultural values at the individual level and the mainstream values in a particular cultural context (Chapter Three). The consistency between the individual-level cultural values and national-level mainstream cultural values may lead individuals to be more compassionate towards themselves, whereas the inconsistency between them might result in greater self-coldness due to cognitive dissonance. The cross-sectional survey study outlined in Chapter Three indicated that Irish participants who tend to prioritize personal needs and pursue equality are more likely to report higher levels of self-compassion since these cultural values at the individual level are in line with the national-level

mainstream cultural values in Ireland (Hofstede, 2023), whereas those who tend to prioritize group harmony and expect hierarchy are more likely to report higher levels of self-coldness in this particular cultural context (Chapter Three). Additionally, the interactions between individual-level cultural values and national-level mainstream cultural values appear to be more complex in the Chinese sample compared to the Irish sample. The possible reason is the dialectical thinking style in Chinese individuals (Peng & Nisbett, 1999; Zhang et al., 2015). Chinese people may embed the attitude towards the "self" in the social context in a more dialectical and complex way, so that one individual-level cultural value can simultaneously lead to self-compassion and self-coldness. For instance, Chinese people who accept and expect social hierarchy tend to view those with higher status as "caregivers" within the group, resulting in a greater sense of compassion for themselves (Hwang, 1987; Jin et al., 2021; Zhong et al., 2006). However, if they fail to meet the expectations of the hierarchy in the group, they may also experience greater self-judgment. Therefore, Chinese individuals may be more inclined to balance the needs of the self with those of the group compared to Irish individuals. Furthermore, this is the first study to explore and demonstrate the moderating role of alexithymia in these relationships (see Chapter Three). In general, individualistic cultural values may be able to mitigate the impairment of alexithymia on emotion regulation through the emphasis on self-focus at the individual level, even though certain aspects of individualistic cultural values may function differently depending on the particular cultural context. Despite only marginal effects being observed and further evidence is needed for robustness, our work contributes preliminary evidence to the field of cross-cultural

alexithymia.

Alexithymia is often considered as an individual trait because it is a relatively stable pattern of thought and behaviour that influences how people process emotional experiences (Mikolajczak & Luminet, 2006; Salminen et al., 2006; Tolmunen et al., 2011). In the existing literature, the longest follow-up supporting alexithymia stability is 11 years (Tolmunen et al., 2011). Nevertheless, previous research suggested that the experience of social reform (e.g., urbanization) might contribute to the population-level shifts in alexithymia (Mattila et al., 2006). For example, China has experienced modernization and urbanization during the reform from a planned economy to a market economy over the past few decades, which fosters more diverse emotional experiences and interpersonal interactions (Chen et al., 2009; Inglehart & Baker, 2000; Sun & Wang, 2010; Xu & Hamamura, 2014; Zeng & Greenfield, 2015). While alexithymia is often taken as a relatively stable individual trait, such transformations might lead to a greater generational focus on emotional awareness, leading to reduced alexithymia at the population level.

Behavioural Benefits Across Cultures

This PhD work also contributes to the design of cross-cultural emotion regulation interventions by providing empirical evidence of the presence and extent of self-compassion and cognitive reappraisal efficacy in the cultural contexts of China and Ireland. The experimental study outlined in Chapter Four demonstrated that these two strategies can effectively relieve negative emotions and promote positive emotions in the Irish and Chinese samples. The behavioural benefits of self-

compassion have been supported by previous studies that were conducted in the Western countries (see Ferrari et al., 2019; Kirby et al., 2017 for reviews) and that were conducted in the Eastern countries (Guan et al., 2021; Huang et al., 2021; Wong & Mak, 2016), although these studies did not directly compare Westerners and Asians. Moreover, previous studies have demonstrated that cognitive reappraisal is beneficial across cultural groups (Ford & Mauss, 2015; Kalibatseva, 2016). In addition, in the present study, self-compassion was found to be more effective in reducing negative emotions across Ireland and China compared to cognitive reappraisal, which is frequently promoted as an adaptive emotion regulation strategy, further strengthening the universal applicability of this increasingly studied strategy.

Neural Activation Patterns are Influenced by Culture

The third key contribution of this PhD work is to demonstrate that culture shapes the neural pathways individuals engage in emotion regulation process even when the behavioural consequences are similar, offering valuable insights into neuro-culture interactions. The EEG experimental study outlined in Chapter Four indicated greater activation at frontal brain regions during self-compassion in the Chinese sample compared to the Irish sample, while the Irish sample showed greater activation at posterior regions during cognitive reappraisal. Culture may shape the specific thought process when practicing emotion regulation strategy, even though the study outlined in Chapter Four did not collect participants' written contents in order to minimizing participants' concerns about confidentiality and anonymity. One

possibility is that Irish individuals (vs. Chinese individuals) are more likely to be self-focused during emotion regulation as a result of repeated participation in cultural practices of independence, compared to Chinese individuals who tend to link the self with contextual information as a result of repeated participation in cultural practices of interdependence (Ford & Mauss, 2015; Hofstede, 2023; Hofstede et al., 2010; Kitayama & Uskul, 2011; Markus & Kitayama, 1991). In addition, greater endorsement of long-term orientation in Chinese individuals (vs, Irish individuals) may cause them to regulate emotions through a future-oriented thought process, whereas Irish individuals may apply value immediate effectiveness of emotion regulation due to greater endorsement of short-term orientation (Hofstede, 2023; Hofstede et al., 2010; Montero-Marin et al., 2018). Considering the lack of direct behavioural evidence in this study, it would be beneficial if future research could provide empirical evidence for the thought processes underlying the differences between the two cultural groups in terms of neural activation patterns.

Exploring Emotion Regulation Based on Dynamic Culture

The fourth key contribution of this thesis is to provide recent empirical evidence for the dynamic nature of culture through measuring cultural values at the individual level, moving beyond the "East-West" dichotomy. Culture is defined as an ever-changing dynamic system in which cultural values and norms change in response to the changing social context (Matsumoto & Juang, 2007). However, most cross-cultural studies in psychology rely on conventional notion at the national level, posting a risk for interpretations of cultural differences that are overly reliant on the

narrow “East-West” dichotomy, which ignores the possible variability within cultural groups. Addressing this, the cross-sectional survey study outlined in Chapter Three did not only collect information about the country of residence but also measured cultural values at the individual level. Contrary to our expectation which is based on the conventional notion at the national level, Chinese individuals endorse similar levels of individualism and even less levels of collectivism compared to Irish individuals. These findings that are based on recent data at the individual level are in line with the changing trend of individualism at the national level from the 1970s (Hofstede et al., 2010; China score = 20, Ireland score = 70) to 2023 (Hofstede, 2023; China = 43, Ireland = 58), indicating that the degree of individualism between China and Ireland is becoming less evident. It has been suggested that Westerners (vs. Asian) are more likely to have the tendency to sacrifice self-interest, a core representation of collectivism, in order to fulfil their commitments to others (Vignoles et al., 2016). In China, moreover, with the market economy reforms that encourages self-improvement and social competition, leading people to endorse and believe individualism-related cultural values (Inglehart & Baker, 2000; Sun & Wang, 2010; Xu et al., 2014; Zeng & Greenfield, 2015). Therefore, our empirical evidence further highlights the necessity to view culture as dynamic in cross-cultural research.

Methodological Improvements

Throughout this PhD work, several methodological considerations are contributed to the research fields of cross-culture and emotion regulation. Following

the systematic review and meta-analysis outlined in Chapter Two, some methodology inadequacies in the existing cross-cultural comparison studies were revealed, including the unclear report of participants' ethnicity, the lack of measuring cultural values at the individual level, the lack of cultural measurement invariance testing, and failing to distinguish between emotional valences. Considering these concerns, efforts have been made to improve the methodology of subsequent empirical studies in this PhD thesis. Firstly, in both the cross-sectional survey study (Chapter Three) and the EEG experimental study (Chapter Four), I clearly reported on the ethnic composition of participants and ensured relatively low ethnic diversity especially in Ireland (for the survey study: 95% White; for the EEG experimental study: 100% White). Secondly, in the survey study, I both collected information about country of residence and measured cultural values at the individual level, to be alert to cultural diversity within a society, since members of a society may have different cultural values. Most of the cross-cultural studies only take country of residence as the proxy of culture and then narrowly interpret cultural differences with cultural dichotomies of individualism-collectivism at the national level, which is opposite to the definition of culture in recent psychology (i.e., culture is a dynamic and everchanging system). Thirdly, in the same survey study, I tested structural measurement equivalence across countries before formal statistical analysis to ensure true cultural differences can be observed and interpreted based on cross-culturally valid instruments. Finally, both positive and negative emotions were measured before and after interventions in the EEG experimental study (Chapter Four). It is not necessary to distinguish between emotional valences in the survey

study in Chapter Three given that the definition of self-compassion focuses on personal suffering which is related to negative emotions.

In addition to these methodological improvements for cross-cultural research, I also made efforts to improve the ecological validity of emotional stimuli for emotion regulation experiments. In the existing literature in the field of emotion regulation, it is common for researchers to induce emotions using standardized databases of emotional stimuli such as the International Affective Picture System (Lang et al., 1997) and the database of emotional film clips (Schaefer et al., 2010). Despite the standardized emotional pictures and film clips can effectively elicit emotions in the laboratory, their similarity to experiences in the real world is doubtful. In the EEG experimental study outlined in Chapter Four, I employed autobiographical emotional stimuli as an alternative, which has been demonstrated to have greater ecological validity in previous studies (Fabiansson et al., 2012; Kneeland et al., 2016; Speed et al., 2020).

Limitations

The current PhD work has some general limitations, despite the specific limitations for particular studies being discussed in the corresponding chapter. Firstly, despite countries being aggregated as parts of East Asia or the West in the large scale cross-cultural comparison study in Chapter Two, I acknowledge there are probably cultural differences between those countries within the West and between those within East Asia. Similarly, despite Ireland and China being taken as representative of Western cultures and East-Asian cultures respectively in the survey

study (Chapter Three) and the EEG study (Chapter Four) due to simple sampling, it is not our claim that these results can be generalized to the broader Western cultural context and East-Asian cultural context.

The second limitation pertains to self-reported questionnaires across cultural groups. In the survey study (Chapter Three), despite all involved measurements being demonstrated to have factor similarity across cultures, the questionnaire I used to measure cultural values did not show completely satisfactory internal consistency. There is a debate about whether *culture* should be measured at the national level or the individual level. While the national scores in the Hofstede's cultural model have been widely used to represent culture in the existing cross-cultural studies, they may not capture variability within cultural groups and may neglect cultural dynamics compassion (Hofstede, 2023; Hofstede et al., 2010). In contrast, cultural measurement at the individual level considers the possibility that individuals within the society endorse different cultural values, which has been supported by the findings in the survey study that collectivism and individualism are not mutually exclusive. However, the challenge of quantifying culture at the individual level is the potential biases of awareness toward their own cultural values. People might compare themselves against those around them in society, influencing the extent to which they self-report their cultural values. While it has been disputed whether culture can be measured by self-report, there are no other alternatives in the existing literature to measure culture, and it is still essential to assess culture at the individual level. Therefore, although the internal consistency of the cultural measurement is not entirely satisfactory in the survey study in Chapter Three, it is still valuable and

innovative since variability within cultural groups is taken into account.

Additionally, although I sought to achieve superior ecological validity in the experimental study, it is still a simulation in the laboratory of real-life emotion regulation. Therefore, despite the benefits of these emotion regulation strategies generated in the laboratory being demonstrated in Chapter Four, the extent to which these findings can be generalized to everyday life is perhaps questionable. In the laboratory, participants were in a very quiet environment with well-structured guidance, which may have made it easier for them to engage in emotion regulation processes. However, they perhaps feel more difficult to employ these strategies when facing emotional episodes in everyday life since various conditions may be needed to drive their behaviours. Recent studies have attempted to incorporate digital technologies in the emotion regulation interventions in everyday life and suggested the effectiveness of supportive text messages as well as mobile applications for emotional monitoring and personalized interventions (see Jadhakhan et al., 2022 for a review). Another attempt for better ecological validity is to incorporate virtual reality (VR) in emotion regulation interventions, making it possible to bring realistic and interactive environments to laboratory (see Colombo et al., 2021 for a review). Despite our experimental study being conducted in the laboratory, the findings still strengthen confidence in the efficacy of these strategies across cultural groups and inform the design of emotion regulation interventions across cultural groups.

Finally, individuals who are not interested in the topic of emotion regulation may not participate our research, which may result in selection bias and may

influence the generalizability of the findings. Previous studies have suggested that some factors may be shared as the drivers of psychological research participation across cultural groups, including benefits obtained from participation (e.g., financial compensation, obtaining information about mental health promotion), altruism – helping other people in the present and future, and low risk of discomfort or invasiveness in participation (George et al., 2014). Some studies further found that Asians maybe less willing to participate in research than Westerners due to distrust attitudes toward research (e.g., concerns about confidentiality and anonymity), especially when researchers are strangers (George et al., 2014; Hu et al., 2023; Liu et al., 2019). Due to the interconnectedness valued in the collectivistic culture, Asians may be driven to participate in the study if they have established trustworthy relationships with researchers or have people around them who are willing to participate (George et al., 2014; Perez et al., 2013). In the studies of this PhD thesis, I made efforts to attract Chinese participants by connecting with Chinese collaborators who could circulate research information among their networks, and asking participants to take away their individualized materials after experiments to minimize their confidentiality and anonymity concerns. I expect our results to generalize to young adults from the educational context in Ireland and China. While the samples in the survey study (Chapter three) and the behavioural EEG study (Chapter four) are not representative of the entire population in Ireland and China, I believe the findings effectively reflect cultural differences since they are in line with recent theoretical and empirical evidence (e.g., the observed levels of cultural values are consistent with Hofstede's updated scores in 2023).

Future Directions

The current PhD work involves various quantitative methods to provide empirical evidence for the research fields of emotion regulation and cross-culture. Given all the studies presented in this PhD thesis are quantitative, it would be beneficial if formal qualitative interviews could be considered as part of the research design in future studies. It can not only capture the subjective experiences of participants, but also inform research questions for the next steps since research design is normally limited by the researcher's knowledge, but the information provided by participants perhaps suggests surprising research directions. In addition, previous studies have raised the possibility that self-compassion capacity improvement requires more time to practice repeatedly (Pennebaker, 1997; Shahar et al., 2012). Therefore, longitudinal research can be considered in future studies to examine the potential long-term effects of emotion regulation exercises, especially when compared with the short-term effects.

We suggest future cross-cultural comparison studies to investigate broader cultural values at the individual level. In addition to individualism-collectivism and power distance, two primary dimensions of cultural values in the model of Hofstede et al. (2010), that were examined in our survey study. Another dimension of cultural values named as long/short-term orientation has been suggested relevant to self-compassion (Montero-Marin et al., 2018). However, due to the lack of measurement in the Chinese language, I was unable to include this cultural value in the current work. Therefore, it is needed to develop culture-related measurements in other

languages for future studies to investigate culture and the relationship between culture and emotion regulation from different perspectives.

Moreover, future studies could conduct more ecologically valid emotion regulation experiments in order to pursue concordance with everyday behaviours. For example, in the real world, it is often that people use multiple approaches to regulate emotions when facing an emotional episode rather than using a particular and single strategy like what most experimental research on emotion regulation did. Baur et al. (2015) has attempted to give participants the freedom to employ whatever strategies they want by only providing generic instructions, in which the effectiveness of such flexible emotion regulation has been supported. Furthermore, considering emotion regulation may be dynamic, Ecological Momentary Assessment (EMA; Colombo et al., 2020) may also be a solution for tracking how people regulate their emotions in everyday life. However, the EMA brings challenges and difficulties to neurophysiological measures such as collecting EEG data. Although mobile EEG is being developed as a novel technique for continuous recording brain activity in daily life (e.g., Park & Donaldson, 2019), the insufficient reporting of the signal-to-noise ratio raises concerns about signal quality. Despite these concerns, technological advances in EEG devices offer promise for capturing brain signals during emotion regulation in the real world.

Methodologically, we suggest future cross-cultural comparison studies to test cultural measurement equivalence before conducting formal data analysis and consider cultural sensitivity when interpreting the results. Applying measurements developed in the West to other cultures comes with several challenges. First, the

understanding of some concepts such as emotional expression may differ across cultures. For example, in the Emotional Expressiveness Questionnaire (EEQ, King & Emmons, 1990), the item "When I am angry people around me usually know" has been taken as a healthy emotional expression based on the Western emotional norms, whereas it may be taken as an excessive expression that violates cultural rules of keeping group harmony in East-Asia (Bhugra & McKenzie, 2003; Elfenbein & Ambady, 2002; Mesquita & Walker, 2003). Thus, caution is needed when interpreting emotional expression across cultures. Second, the measured construct of Western psychological models may not be universally applicable across cultural groups. In the survey study (Chapter three), instead of directly applying the one-factor construct of the self-compassion measurement developed in the West, I assessed whether it worked effectively for both Irish and Chinese cultural groups and suggested the two-factor construct in the Chinese sample. Thus, future studies need to adjust psychological models according to specific contexts.

Another methodological suggestion is to establish more specific exclusion / inclusion criteria that consider possible cultural differences within the particular country, especially in large countries such as China. For example, Talhelm's rice theory of culture (2014) suggested that rice regions in the south of China are more likely to value interdependence and holistic thinking style compared to wheat regions in the north of China. As rice' labor requirements are almost twice those of wheat, purely independent labor could not afford the farming work necessary to support themselves, fostering an environment of interdependence (Talhelm, 2022; Talhelm et al., 2014). Furthermore, Talhelm and his colleagues found that the effect of rice-

wheat categorical variable on cultural thought style within China is significant smaller than the effect of East-West categorical variable between the Chinese and US samples (Talhelm et al., 2014). Therefore, although regional differences exist within China, they are still relatively small in comparison with the greater cultural differences between East Asia and the West. Future studies could compare such subcultures in a particular East-Asian country (e.g., China) with Western cultures (e.g., Ireland) to observe differences and similarities in emotion regulation practices.

Finally, the current work mainly focuses on self-compassion, one of the emotion regulation strategies that has been identified as research gaps by the systematic review and meta-analysis in Chapter Two. However, other strategies (acceptance, distraction, and mindfulness) remain understudied in cross-cultural comparison studies and future investigations are needed.

Summing up, future directions could consider including quantitative research and longitudinal studies, investigating broader cultural values, improving ecological validity in emotion regulation experimental research, making efforts to test cultural measurement equivalence, and focusing more on acceptance, distraction, mindfulness, and self-compassion in cross-cultural comparisons.

Conclusions

This PhD work involves various research types which are systematic review and meta-analysis, cross-sectional survey, as well as behavioural and neurophysiological experiments, providing empirical evidence for how culture (specifically Western culture vs. East-Asian culture) shapes emotion regulation in

the aspects of regulatory frequency, behavioural consequences, as well as neural activation patterns. In doing these, I made efforts to improve 1) methodological inadequacies in cross-cultural comparison studies and 2) ecological validity in emotion regulation experimental research. This PhD work began with identifying research gaps that need to be addressed by future cross-cultural comparison studies including self-compassion, acceptance, distraction, and mindfulness. I then focused on self-compassion and found the behavioural benefits of self-compassion are universal across cultural groups, but the use frequency and neural activation patterns of self-compassion are different between the Chinese and Irish samples. This PhD work contributes empirical evidence to the fields of emotion regulation and cross-culture, informing the design of emotion regulation interventions cross-culturally, and providing a deeper understanding of neuro-culture interactions.

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Appendix 1: Search strategies of databases in Chapter Two

Web of Science

Search	Concept	Query
#1	Emotion regulation	TS=("emotion regulat*" OR "emotional regulat*" OR "affect regulat*" OR "affective regulat*" OR "emotion dysregulat*" OR "emotional dysregulat*" OR "affect dysregulat*" OR "affective dysregulat*")
#2	Emotion regulation strategy	TS=(suppression OR reappraisal OR acceptance OR avoidance OR rumination OR mindfulness OR distraction OR express* OR "self-compassion" OR strateg*)
#3	Cross-culture	TS=("different cultur*" OR "cross cultur*" OR "across cultur*" OR "cultural variation*" OR "cultural difference*" OR "culturally different*" OR "culturally diverse" OR "cross ethnic" OR "ethnic difference*" OR "racial difference*" OR "cross national*" OR "national difference*" OR "cultural context*" OR "cultural background*" OR "cultural norm*" OR "cultural value*" OR "cultural orientation" OR "cultural dimension*" OR "cultural group*" OR "culturally relevant" OR "cultural perspective*" OR "culture specific" OR "cultural specificity" OR international OR multinational OR transcultur* OR multicultur*)
#4		#1 AND #2 AND #3
Items found: 661		

Scopus

Search	Concept	Query
#1	Emotion regulation	TITLE-ABS-KEY("emotion regulat*" OR "emotional regulat*" OR "affect regulat*" OR "affective regulat*" OR "emotion dysregulat*" OR "emotional dysregulat*" OR "affect dysregulat*" OR "affective dysregulat*")
#2	Emotion regulation strategy	TITLE-ABS-KEY(suppression OR reappraisal OR acceptance OR avoidance OR rumination OR mindfulness OR distraction OR express* OR "self-compassion" OR strateg*)
#3	Cross-culture	TITLE-ABS-KEY("different cultur*" OR "cross cultur*" OR "across cultur*" OR "cultural variation*" OR "cultural difference*" OR "culturally different*" OR "culturally diverse" OR "cross ethnic" OR "ethnic difference*" OR "racial difference*" OR "cross national*" OR "national difference*" OR "cultural context*" OR "cultural background*" OR "cultural norm*" OR "cultural value*" OR "cultural orientation" OR "cultural dimension*" OR "cultural group*" OR "culturally relevant" OR "cultural perspective*" OR "culture specific" OR "cultural

		specificity" OR international OR multinational OR transcultur* OR multicultur*)
#4		#1 AND #2 AND #3
Items found: 636		

PsycINFO

Search	Concept	Query
#1	Emotion regulation	DE "emotional regulation" OR AB "emotion regulat*" OR AB "emotional regulat*" OR AB "affect regulat*" OR AB "affective regulat*" OR AB "emotion dysregulat*" OR AB "emotional dysregulat*" OR AB "affect dysregulat*" OR AB "affective dysregulat*"
#2	Emotion regulation strategy	AB suppression OR AB reappraisal OR AB acceptance OR AB avoidance OR AB rumination OR AB mindfulness OR AB distraction OR AB express* OR AB "self-compassion" OR AB strateg*
#3	Cross-culture	DE "Cross Cultural Differences" OR AB "different cultur*" OR AB "cross cultur*" OR AB "across cultur*" OR AB "cultural variation*" OR AB "cultural difference*" OR AB "culturally different*" OR AB "culturally diverse" OR AB "cross ethnic" OR AB "ethnic difference*" OR AB "racial difference*" OR AB "cross national*" OR AB "national difference*" OR AB "cultural context*" OR AB "cultural background*" OR AB "cultural norm*" OR AB "cultural value*" OR AB "cultural orientation" OR AB "cultural dimension*" OR AB "cultural group*" OR AB "culturally relevant" OR AB "cultural perspective*" OR AB "culture specific" OR AB "cultural specificity" OR AB international OR AB multinational OR AB transcultur* OR AB multicultur*
#4		#1 AND #2 AND #3
Items found: 355		

PubMed

Search	Concept	Query
#1	Emotion regulation	"emotional regulation"[majr] OR "emotion regulat*"[tiab] OR "emotional regulat*"[tiab] OR "affect regulat*"[tiab] OR "affective regulat*"[tiab] OR "emotion dysregulat*"[tiab] OR "emotional dysregulat*"[tiab] OR "affect dysregulat*"[tiab] OR "affective dysregulat*"[tiab]
#2	Emotion regulation strategy	suppression[tiab] OR reappraisal[tiab] OR acceptance[tiab] OR avoidance[tiab] OR rumination[tiab] OR mindfulness[tiab] OR distraction[tiab] OR express*[tiab] OR "self-compassion"[tiab] OR strateg*[tiab]

#3	Cross-culture	"Cross-Cultural Comparison"[majr] OR "Cultural Diversity"[majr] OR "different cultur*"[tiab] OR "cross cultur*"[tiab] OR "across cultur*"[tiab] OR "cultural variation*"[tiab] OR "cultural difference*"[tiab] OR "culturally different*"[tiab] OR "culturally diverse"[tiab] OR "cross ethnic"[tiab] OR "ethnic difference*"[tiab] OR "racial difference*"[tiab] OR "cross national*"[tiab] OR "national difference*"[tiab] OR "cultural context*"[tiab] OR "cultural background*"[tiab] OR "cultural norm*"[tiab] OR "cultural value*"[tiab] OR "cultural orientation"[tiab] OR "cultural dimension*"[tiab] OR "cultural group*"[tiab] OR "culturally relevant"[tiab] OR "cultural perspective*"[tiab] OR "culture specific"[tiab] OR "cultural specificity"[tiab] OR international[tiab] OR multinational[tiab] OR transcultur*[tiab] OR multicultur*[tiab]
#4		#1 AND #2 AND #3
Items found: 289		

ProQuest Dissertations & Theses Global

Search	Concept	Query
#1	Emotion regulation	abstract("emotion regulat*" OR "emotional regulat*" OR "affect regulat*" OR "affective regulat*" OR "emotion dysregulat*" OR "emotional dysregulat*" OR "affect dysregulat*" OR "affective dysregulat*")
#2	Emotion regulation strategy	abstract(suppression OR reappraisal OR acceptance OR avoidance OR rumination OR mindfulness OR distraction OR express* OR "self-compassion" OR strateg*)
#3	Cross-culture	abstract("different cultur*" OR "cross cultur*" OR "across cultur*" OR "cultural variation*" OR "cultural difference*" OR "culturally different*" OR "culturally diverse" OR "cross ethnic" OR "ethnic difference*" OR "racial difference*" OR "cross national*" OR "national difference*" OR "cultural context*" OR "cultural background*" OR "cultural norm*" OR "cultural value*" OR "cultural orientation" OR "cultural dimension*" OR "cultural group*" OR "culturally relevant" OR "cultural perspective*" OR "culture specific" OR "cultural specificity" OR international OR multinational OR transcultur* OR multicultur*)
#4		#1 AND #2 AND #3
Items found: 194		

Appendix 2: Characteristics, included countries, and risk of bias of eligible studies in Chapter Two

Characteristics of eligible studies

Author /Year	Western participants	East-Asian participants	Valence of emotion	Emotion regulation strategy and Measurement	Cultural measurement invariance
Han et al. (2022) Study 1	European American, n=152, mean age 40.68, 55.92%F.	Korean, n=197, mean age 42.50, 59.39%F	Positive, Negative	Suppression: PANAS	Did not test
Han et al. (2022) Study 2	European American, n=85, mean age 39.78, 56.47%F	Korean, n=220, mean age 35.59, 53.18%F	Positive, Negative	Suppression: ERQ	Did not test
He et al. (2021)	White from UK, n=40, mean age 20.05, 50%F	Chinese, n=40, mean age 20.53, 50%F	Did not specify	Suppression: ERQ Reappraisal: ERQ	Did not test
Kahn et al. (2017)	European American, n=209, mean age=19.99, 67.94%F	Chinese (Taiwan), n=255, mean age 19.99, 38.67%F	Expression: Negative Mindfulness: Did not specify	Expression: DDI Mindfulness: MAAS	Did not test
Kang et al. (2003)	European American, n=170, 75.88%F	Korean, n=179, 55.87%F Chinese, n=141, 50.35%F	Did not specify	Expression: EEQ	Factor analyses: four items from EEQ were removed due to their negative loadings on the first unrotated factor
Krys et al. (2022)	Westerner from 15 Western countries, n= 3,947, 56.43%F	East-Asian from 5 East-Asia countries and regions, n=1,106, 51.92%F	Positive, Negative	Expression: AVI	Multilevel CFA: the structure of AVI was comparable, albeit not identical.
Matsumoto et al. (2008)	Westerner from 8 Western countries, n=770, 59.22%F	East-Asian from 4 East-Asia countries and regions, n=615, 46.50%F	Did not specify	Suppression: ERQ Reappraisal: ERQ	Multigroup CFA & EFA: the factor structure of ERQ was supported
Maxwell et al. (2005)	British, n = 495, mean age 21.54, 53.94%F	Chinese (Hong Kong), n = 453, mean age 23.25, 49.23%F	Negative	Rumination: ARS	CFA: model was modified due to a less than ideal fit.

Nishiguchi et al. (2022)	German, n = 2200, mean age 45.51, 39.59%F	Japanese, n =1200, mean age 44.7, 50.25%F	Did not specify	Avoidance: MAX	EFA & CFA: the avoidance subscale of MAX was compared although some of the fit indices did not indicate an acceptable model fit
Nozaki (2018) Study 1	European American, n=264, mean age 34.82, 45.08%F	Japanese, n=260, mean age 40.17, 50%F	Did not specify	Suppression: ERQ Reappraisal: ERQ	Did not test
Nozaki (2018) Study 2	European American, n=502, mean age 37.71, 57.97%F	Japanese, n=538, mean age 48.90, 31.41%F	Did not specify	Suppression: ERQ Reappraisal: ERQ	Did not test
O'Connor & Shimizu (2002)	British, n=80, mean age 21.80, 55.00%F	Japanese, n=84, mean age 21.77, 57.14%F	Did not specify	Reappraisal: WCQ Avoidance: WCQ	Did not test
Orkibi et al. (2021)	Italian, n=244, mean age 35, 72%F	Chinese, n=569, mean age 29, 60%F	Did not specify	Suppression: ERQ Reappraisal: ERQ	Configural invariance, metric invariance, scalar invariance: although respondents differed by the factor levels, the factors similarity was perceived by participants
Rich et al. (2022)	European American, n = 6,442, mean age 41.4, 71.2%F	Chinese, n = 10,268, mean age 53.2, 60.3%F Chinese (Taiwan), n = 3,033, mean age 54.4, 68.1%F	Did not specify	Mindfulness: an item of Contemplative Practice Behavior (CPB) created by authors Self-compassion: an item of Contemplative Practice Behavior (CPB) created by authors	Did not test
Schunk et al. (2021)	German, n=148, mean age 22.72, 70.3%F	Chinese (Hong Kong), n=125, mean age 20.38, 68.8%F Japanese, n=127, mean age 18.69, 40.2%F	Rumination: Negative Suppression and Reappraisal: Did not specify	Suppression: ERQ Reappraisal: ERQ Rumination: PTQ	Congruence coefficients (Tucker's phi): factor structural equivalence was demonstrated

Schunk et al. (2022)	German and Austrian, n=476, mean age 21.71, 60.9%F	Japanese, n=524, mean age 19.00, 36.8%F	Suppression and Distraction: Positive, Negative Reappraisal, Acceptance, and Rumination: Negative	Suppression: ERQ Reappraisal: ERQ Acceptance: ERI Rumination: PTQ Distraction: ERI	Congruence coefficients (Tucker's phi): factor structural similarity was demonstrated
Schunk et al. (2023)	German, n = 129, mean age 21.26, 70.5%F	Chinese (Hong Kong), n = 136, mean age 19.94, 69.9%F Japanese, n = 123, mean age 18.91, 32.5%F	Rumination: Negative Suppression and Reappraisal: Did not specify	Rumination: PTQ Suppression: ERQ Reappraisal: ERQ	CFA: one item from PTQ and one item from the reappraisal subscale of ERQ were removed due to their low standardized loadings (<0.500)
Soto et al. (2011)	European American, n=71, mean age 19.22, 59%F	Chinese (Hong Kong), n=100, mean age 20.61, 52%F	Did not specify	Suppression: ERQ Reappraisal: ERQ	Did not test
Su et al. (2014)	European American, n=224, mean age 19.41, 69%F	Chinese (Taiwan), n=190, mean age 20.56, 44%F	Did not specify	Suppression: ERQ Avoidance: AAQ-II	Did not test
Wei et al. (2013)	European American, n=246, mean age 19.23, 68.70%F	Chinese (Taiwan), n=205, mean age 20.03, 55.12%F	Suppression: Did not specify Expression: Negative	Suppression: ERQ Expression: DDI	Factor analyses: reasonably good fit was demonstrated for ERQ and DDI
Zhou et al. (2022) Study 1	European American, n=150, 52.70%F	Chinese (Taiwan), n=150, 50%F	Did not specify	Suppression: ERQ Reappraisal: ERQ	MACS: one item with inequivalent intercepts in the suppression subscale of ERQ was removed

Notes: F: female; CFA: confirmatory factor analyses; EFA: exploratory factor analyses; MACS: analyses of mean and covariance structures; AAQ-II: the Acceptance and Action Questionnaire-II (Bond et al., 2011); ARS: the Anger Rumination Scale (Sukhodolsky et al., 2001); AVI: the Affect Valuation Index (Tsai et al., 2006); DDI: the Distress Disclosure Index (Kahn & Hessling, 2001); EEQ: the Emotional Expressiveness Questionnaire (King & Emmons, 1990); ERI: the Emotion Regulation Inventory (König, 2011); ERQ: the Emotion Regulation Questionnaire (Gross & John, 2003); MAAS: the Mindful Attention Awareness Scale (Brown & Ryan, 2003); MAX: the Maladaptive and Adaptive Coping Style Questionnaire (Moritz et al., 2016); PANAS: the Positive and Negative Affect Schedule (Watson et al., 1998); PTQ: the Perseverative Thinking Questionnaire (Ehring et al., 2011); WCQ: the modified version of the Ways of Coping Questionnaire (Folkman et al., 2000)

Countries included in eligible studies

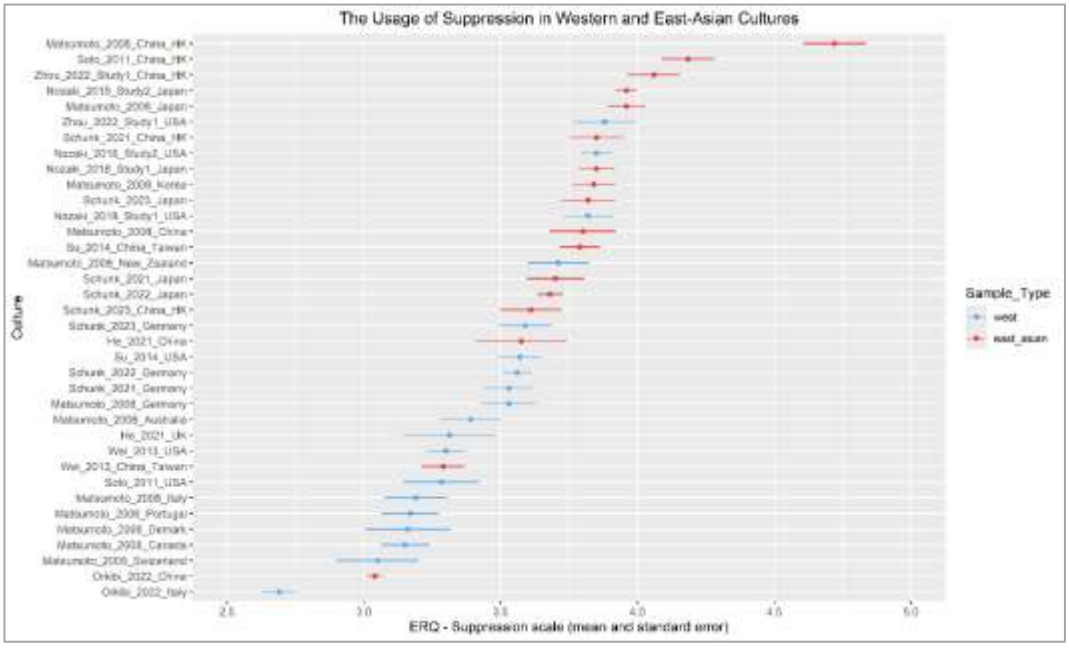
For the West, most studies were conducted in the United States (k = 12), followed by Germany (k = 6), the United Kingdom (k = 4), Italy (k = 3). Australia, Canada, Portugal, Switzerland were represented in two studies. Ireland, France, Iceland, Norway, Austria, Luxembourg, Netherlands, Demark, and New Zealand were involved in one study. For the East Asia, most studies were conducted in China (k = 14), with six studies involved Hong Kong, and six studies involved Taiwan. Nine studies were conducted in Japan and five in South Korea.

Risk of bias of all eligible studies

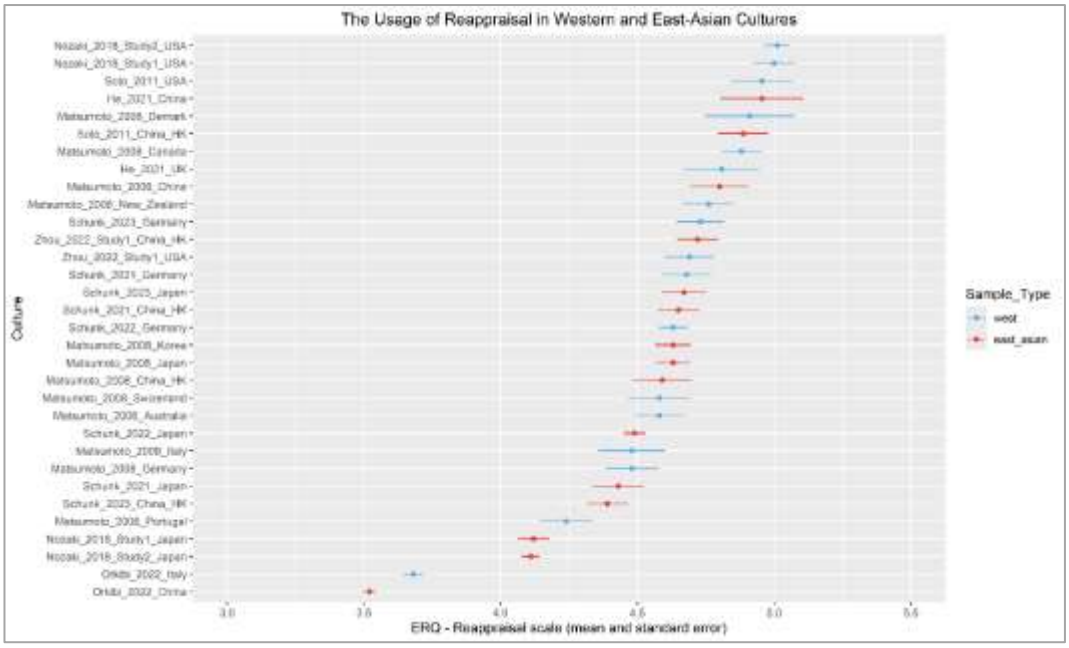
First author (year) Study (If applicable)	Preliminaries	Introduction	Design	Sampling	Data collection	Ethical matters	Results	Discussion	Total%	Classification
Han et al. (2022) Study 1	4	5	4	4	4	4	2	4	78%	High
Han et al. (2022) Study 2	4	5	4	3	4	4	2	4	75%	High
He et al. (2021)	4	5	3	5	3	3	3	4	75%	High
Kahn et al. (2017)	5	5	4	4	4	3	5	5	88%	High
Kang et al. (2003)	5	5	4	4	5	3	4	5	88%	High
Krys et al. (2021)	5	5	5	3	5	4	5	5	93%	High
Mastsumoto et al. (2008)	5	5	3	4	5	4	5	5	90%	High
Maxwell et al. (2005)	5	5	5	5	5	5	4	4	95%	High
Nishiguchi et al. (2022)	5	5	4	4	5	5	4	5	93%	High
Nozaki (2018) Study 1	4	5	5	5	4	3	5	5	90%	High
Nozaki (2018) Study 2	4	5	5	5	4	3	5	5	90%	High
O'Connor & Shimizu (2022)	5	5	5	4	5	3	5	4	90%	High
Orkibi et al. (2021)	4	5	5	4	5	4	5	5	93%	High
Rich et al. (2022)	5	5	3	5	4	4	5	5	90%	High
Schunk et al. (2021)	5	5	5	5	5	4	5	5	98%	High
Schunk et al. (2022)	4	4	3	4	4	4	4	4	78%	High
Schunk et al. (2023)	5	5	5	5	5	3	5	5	95%	High
Soto et al. (2011)	5	5	4	4	5	4	4	5	90%	High
Su et al. (2014)	4	5	3	5	5	3	4	5	85%	High
Wei et al. (2013)	5	5	4	4	5	5	4	5	93%	High
Zhou et al. (2022) Study 1	5	5	5	5	4	4	3	4	88%	High

Appendix 3: The variation between studies in Chapter Two

Dot-and-whisker plot for the variation between the studies for the effects of culture on the spontaneous use frequency of suppression



Dot-and-whisker plot for the variation between the studies for the effects of culture on the spontaneous use frequency of reappraisal



Appendix 4: Results of the balanced sample for Chapter Three

Cultural mean differences, internal consistencies, cultural measurement equivalence, and Pearson's correlations

Variable	*M*	*SD*	α	φ	1	2	3	4	5	6	7
1. Self-Compassion	3.39	0.89	.92	.98	1	-	-	-	-	-	-
2. Self-Coldness	2.77	0.84	.88	.98	0.02	1	-	-	-	-	-
3. HI	5.57	1.56	.80	.94	0.60***	0.20	1	-	-	-	-
4. VI	4.67	1.37	.70	.91	0.17	0.34***	0.35***	1	-	-	-
5. HC	5.45	1.59	.82	.85	0.48***	0.25*	0.65***	0.33***	1	-	-
6. VC	5.32	1.65	.81	.83	0.42***	0.40***	0.67***	0.35***	0.78***	1	-
7. Alexithymia	53.46	12.77	.87	.98	-0.27*	0.37***	-0.13	0.18	-0.15	0.02	1

Note. α = Cronbach's alpha; φ= Tucker's phi; HI = Horizontal Individualism; VI = Vertical Individualism; HC = Horizontal Collectivism; VC = Vertical Collectivism; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Chinese sample size was randomly down-sampled from 260 to 137 (age: $M = 27.68$, $SD = 9.48$, 60.58% Females, 100% Chinese). In the balanced dataset, Chinese participants reported higher level of self-compassion [$t(272) = 3.45$, $p < .001$] and lower level of self-coldness [$t(272) = -5.95$, $p < .001$] than Irish participants. Chinese sample reported lower levels of HI [$t(272) = -7.63$, $p < .001$] and higher levels of VC [$t(272) = 2.56$, $p = .01$] compared to Irish sample. Chinese sample reported slightly lower levels of HC [$t(272) = -2.42$, $p = .02$] than Irish sample, and the mean levels of VI did not differ across cultures. There was no difference in the levels of alexithymia between the two samples.

Multiple regression analysis examining the moderating effects of alexithymia on the relation between cultural values and self-compassion

Dependent variable					
Predictor	*B*	*SE B*	95% CI	*t*	ΔR^2
Step 1					0.009
Age	0.008	0.008	[-0.008, 0.02]	0.95	
Gender	-0.09	0.16	[-0.40, 0.22]	-0.58	
Step 2					0.36***
Age	0.002	0.007	[-0.01, 0.02]	0.29	
Gender	-0.15	0.13	[-0.41, 0.12]	-1.10	
HI	0.31	0.06	[0.20, 0.42]	5.44***	
VI	-0.06	0.05	[-0.16, 0.04]	-1.17	
HC	0.12	0.07	[-0.01, 0.25]	1.84	
VC	-0.06	0.07	[-0.19, 0.07]	-0.91	
Step 3					0.03*
Age	-0.002	0.007	[-0.02, 0.01]	-0.35	
Gender	-0.13	0.13	[-0.40, 0.13]	-1.01	
HI	0.29	0.06	[0.17, 0.40]	5.06***	
VI	-0.04	0.05	[-0.14, 0.07]	-0.70	
HC	0.08	0.07	[-0.05, 0.22]	1.26	
VC	-0.02	0.07	[-0.15, 0.11]	-0.30	
Alexithymia	-0.01	0.005	[-0.02, -0.002]	-2.35*	
Step 4					0.03
Age	-0.0004	0.007	[-0.01, 0.01]	-0.07	
Gender	-0.07	0.14	[-0.34, 0.20]	-0.53	
HI	0.29	0.06	[0.18, 0.41]	5.07***	
VI	-0.02	0.05	[-0.13, 0.08]	-0.46	
HC	0.11	0.07	[-0.02, 0.25]	1.62	
VC	-0.04	0.07	[-0.18, 0.09]	-0.61	
Alexithymia	-0.01	0.005	[-0.02, 0.001]	-1.79	
HI × Alexithymia	0.01	0.004	[0.002, 0.02]	2.35*	
VI × Alexithymia	-0.001	0.004	[-0.008, 0.006]	-0.32	
HC × Alexithymia	-0.003	0.005	[-0.01, 0.006]	-0.72	
VC× Alexithymia	-0.002	0.004	[-0.01, 0.007]	-0.43	

Note. HI = Horizontal Individualism; VI = Vertical Individualism; HC = Horizontal Collectivism; VC = Vertical Collectivism; CI = confidence interval; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Multiple regression analysis examining the moderating effects of alexithymia on the relation between cultural values and self-coldness

Dependent variable					
Predictor	*B*	*SE B*	95% CI	*t*	ΔR^2
Step 1					0.02
Age	-0.01	0.008	[-0.03, 0.005]	-1.35	
Gender	-0.07	0.15	[-0.36, 0.23]	-0.46	
Step 2					0.22***
Age	-0.01	0.007	[-0.02, 0.003]	-1.53	
Gender	0.04	0.14	[-0.24, 0.32]	0.26	
HI	-0.09	0.06	[-0.20, 0.03]	-1.43	
VI	0.15	0.05	[0.04, 0.26]	2.69**	
HC	-0.08	0.07	[-0.22, 0.05]	-1.20	
VC	0.28	0.07	[0.14, 0.41]	4.01***	
Step 3					0.07***
Age	-0.004	0.007	[-0.02, 0.01]	-0.56	
Gender	0.01	0.13	[-0.25, 0.28]	0.11	
HI	-0.05	0.06	[-0.16, 0.06]	-0.86	
VI	0.11	0.05	[0.004, 0.21]	2.06*	
HC	-0.03	0.07	[-0.16, 0.11]	-0.38	
VC	0.21	0.07	[0.08, 0.35]	3.13**	
Alexithymia	0.02	0.005	[0.009, 0.03]	3.60***	
Step 4					0.04
Age	-0.005	0.007	[-0.02, 0.009]	-0.66	
Gender	-0.004	0.14	[-0.28, 0.27]	-0.03	
HI	-0.06	0.06	[-0.18, 0.06]	-1.04	
VI	0.09	0.05	[-0.01, 0.20]	1.76	
HC	-0.06	0.07	[-0.20, 0.08]	-0.90	
VC	0.25	0.07	[0.12, 0.39]	3.64***	
Alexithymia	0.02	0.006	[0.004, 0.03]	2.70**	
HI × Alexithymia	-0.005	0.004	[-0.01, 0.004]	-1.12	
VI × Alexithymia	-0.001	0.004	[-0.009, 0.006]	-0.41	
HC × Alexithymia	-0.004	0.005	[-0.01, 0.006]	-0.75	
VC× Alexithymia	0.01	0.004	[0.002, 0.02]	2.53*	

Note. HI = Horizontal Individualism; VI = Vertical Individualism; HC = Horizontal Collectivism; VC = Vertical Collectivism; CI = confidence interval; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Appendix 5: Informed consent sheet used in Chapter Three

Survey in Ireland

Welcome to the research study!

The purpose of this study is to investigate how culture influences emotion regulation in Ireland and China. Should you choose to participate, you will be asked to complete a series of questionnaires, which will include items on emotion and culture. Participants should be adults who are (1) aged over 18, (2) living in Ireland, and (3) who have never attended any self-compassion/mindfulness training before. If you do not meet these eligibility requirements, please do not take part in this study.

The study should take around 20 minutes to complete. Your participation in this research is voluntary. There is no obligation to participate, and should you choose to do so you can refuse to answer specific questions or decide to withdraw from the study prior to completing the survey, by exiting the survey. All information you provide will be confidential and your anonymity will be protected throughout the study.

You maintain the right to withdraw from the study at any stage up to the point of data submission. At this point, your data will be collated with that of other participants and can no longer be retracted. Your anonymied data will be stored on the University College Cork supported Microsoft OneDrive indefinitely, and

will be uploaded to an open access repository (e.g., Open Science Framework) to allow the data to be reused for subsequent research studies. The reason for indefinite storage is that we will follow FAIR principles (findable, accessible, interoperable and reusable) to make data publicly available. The information you provide may contribute to research publications and/or conference presentations.

We do not anticipate any negative outcomes from participating in this study. However, if you should feel any distress, please contact your local mental health services. This study has obtained ethical approval from the UCC Social Research Ethics Committee. If you have any queries about this research, please feel free contact me (Hongru Song) by email.

By clicking the button below, you acknowledge:

- I confirm that I am an adult whose age is 18 or over.
- I confirm that I live in Ireland.
- I confirm that I never attended any self-compassion/mindfulness training before this study.
- The purpose and nature of the study has been explained to me in writing.
- I am participating voluntarily.
- I understand that I can withdraw from the study, without repercussions, at any time, whether before it starts or while I am participating, but my data will no longer be retracted after submitting the survey.
- I understand that consenting to participate in this study means I allow for my anonymised data to be stored on the University College Cork

supported Microsoft OneDrive indefinitely, later, on an open access repository indefinitely to make data publicly available, then my anonymised data will be FAIR (findable, accessible, interoperable and reusable) for subsequent research studies.

○ I confirm that I am an adult whose age is 18 or over, that I never attend any self-compassion/ mindfulness training before, that I have read and understood the study information statement, that I have ability to complete the questionnaires unaided, and that I consent to take part in this study.

○ I do not consent, I do not wish to participate.

Survey in China

欢迎来到本项研究！

此研究的目的是调查文化如何对情绪调节产生影响。我们将在中国、爱尔兰、美国和英国进行调查。如果您选择参加此研究，您将完成一系列问卷，这些问卷将包括对情绪调节、心理状态、文化价值观的测量。参加者必须是（1）18 岁以上的成年人，（2）居住在中国，（3）从未参加过任何自我同情/正念训练。请注意，如果您的情况与这些要求中的任何一个不一致，您应该退出这项研究，以节省您的时间。

此研究将花费您大约 20 分钟。此研究的参与是自愿性的，而非义务性的。在完成全部问卷之前，您可以自行决定是否退出研究。您在调查过程中提供的全部信息都将是匿名的。

您有权在提交数据之前的任何阶段退出研究。但是，在提交之后，您的数据将与其他参与者的数据混合在一起，无法再撤回。 你的匿名数据将会被永久储存在爱尔兰国立科克大学的 Microsoft OneDrive 上，并将上传到开放存储库(例如：Open Science Framework)，以允许后续研究对数据进行重复使用。数据被永久存储的原因是，我们遵循欧盟开放科学数据的 FAIR 原则（Findable - 可查找，Accessible - 可获取，Interoperable - 可互操作和 Re-usable 可重复使用）以使数据公开可用。您提供的信息可能会为研究出版物和/或会议报告做出贡献。

我们预计参加本项研究不会对您到来任何负面后果。如果您因参与研究而感到不适，请联系您所在地的心理健康服务。 此项研究已经获得爱尔兰国立科克大学社会研究伦理委员会的伦理道德批准。

如果您对这项研究有任何疑问，可以通过电子邮件与我取得联系。

如果您点击底部的 “同意” 按钮，则意味着您确认如下内容:

- 我确认我是一个 18 岁或 18 岁以上的成年人。
- 我确认我的居住国家是中国。
- 我确认在本项研究之前，我从未参加过任何自我同情/正念训练。
- 本项研究的目的和性质已经以书面形式向我进行了解释。
- 我自愿参加本项研究。
- 我已经知悉，我可以在任何时候退出这项研究，不管是在研究开始之前还是在我参与研究期间，这不会对我产生任何影响，但是在提交调查之后，我的数据将无法被撤回。
- 我已经知悉，同意参加这项研究意味着我允许：我的匿名数据将会永久储存在爱尔兰国立科克大学的 Microsoft OneDrive 上，并将上传到开放存储库(例如：Open Science Framework)，以允许后续研究对数据进行重新使用。数据被无限期存储的原因是，我们

遵循欧盟开放科学数据的 FAIR 原则（Findable - 可查找，Accessible - 可获取，Interoperable - 可互操作和 Re-usable 可重复使用）以使数据公开可用。

○ 我确认我是一个 18 岁或 18 岁以上的成年人，从未参加过任何自我同情/正念训练，我已经阅读并理解了有关于本项研究的陈述信息，我有能力独立完成问卷调查，我同意参加本项研究。

○ 我不同意，我不希望参与本项研究。

Appendix 6: Informed consent sheet used in Chapter Four

Experiments in Ireland

Title of the Study: Neural Activation Patterns During Emotion Regulation: An Electroencephalography (EEG) Study

What is Involved

You will be required to engage in the writing tasks start with recalling an upsetting personal memory and using emotion regulation strategies, during which your brain activity will be measured using EEG (Electroencephalography) equipment. EEG equipment will only be used to record data, but not being used for any diagnostic or technical purposes.

Risks and Benefits

Given the nature of this research, you will be asked to recall an upsetting personal memory, which may cause some distress. The risks involved in recalling a personal upsetting memory are in keeping with the memory experiences of everyday life, and we do not anticipate this will require specific supports. However, if you are currently accessing supports for mental health difficulties, we advise you not to take part. Secondly, if you do experience distress from these memories and need further support, please tell the researchers and they will sign-post you to appropriate support services.

The main benefit of this research will hopefully provide us with the evidence for the efficacy of emotion regulation strategies in terms of reducing emotions by

deepening our understanding of the underlying brain mechanisms, that will impact positively on designing emotion regulation interventions.

Please confirm the contents below:

- ○ I confirm that I am an adult whose age is 18 or over.
- ○ I confirm that I live in Ireland.
- ○ I confirm that I am not currently accessing support from mental health services.
- ○ The study has been explained fully to me.
- ○ All experimental procedures have been identified and no guarantee has been given about the possible results.
- ○ I have had the opportunity to ask questions concerning all aspects of the project and any procedures involved.
- ○ I am participating voluntarily and that I can withdraw my consent at any time without consequence, but my data will no longer be retracted after testing since the anonymised data will be collated with that of other participants at this point.
- ○ I understand that consenting to participate in this study means I allow for my anonymised data to be stored on the University College Cork supported Microsoft OneDrive indefinitely, later, on an online open access repository indefinitely to make data publicly available, for subsequent research studies that

approved by a regulated ethics committee. The reason for indefinite storage is that we will follow FAIR principles (findable, accessible, interoperable and reusable) to make data publicly available.

○ I understand that my anonymised data will be stored at UCC, together with data from a similar parallel study in China, but my anonymised data will not be shared with any Chinese institution.

○ I understand that the investigators have such insurance as is required by law in the event of injury as a direct result of my participation in the study.

○ I understand that if I have further questions concerning the study, I can contact the investigators.

○ I understand that the study has been approved by the Clinical Research Ethics Committee of the Cork Teaching Hospitals (CREC) and if I have further queries concerning my rights in connection with the research, I can contact the CREC at Lancaster Hall, 6 Little Hanover Street, Cork by email at crec@ucc.ie.

○ I confirm that I have ability to complete the questionnaires unaided.

Please chose one of the options below to decide whether you consent to take part in this study.

○ I consent to take part in this study (including both questionnaires and testing which have been explained fully to me).

○ I do not consent, I do not wish to participate.

Participant Signature: _____

Date: _____

Experiments in China

研究主题: 情绪调节过程中的神经活动机制： 一个脑电图 (EEG)研究

本研究包含什么

这项研究将需要您来到 陕西师范大学心理学院的实验室，在电脑上完成所有的研究过程，其中包括一次 3 小时的访问。您将被要求进行写作训练，首先回忆一个令人沮丧的个人记忆，并使用情绪调节策略，在此期间，您的大脑活动数据将会被记录。脑电图设备只用于记录数据，并不会用于任何诊断或技术目的。本次实验完全匿名。

风险和益处

鉴于本研究的性质，您将被要求回忆一段令人沮丧的个人记忆，这可能会导致一些痛苦。回忆的这段令人沮丧的记忆将来自于您的日常生活中，所以我们并不预期这将需要特定的心理健康支持。然而，如果你目前正在寻求心理健康服务的支持，我们建议你不要参与。其次，如果你确实因为这些记忆而感到痛苦，需要进一步的支持，请告诉研究人员，他们会向您推荐适当的支持服务。

这项研究的主要好处是，通过加深对潜在的大脑机制的理解，有希望为情绪调节策略在调节情绪方面的功效提供证据，这将有助于情绪调节干预措施的设计。

请确认以下内容，并在左侧打勾:

○ 我确认我是一个 18 岁或以上的成年人。

○ 我确认我居住在中国。

○ 我确认我现在没有寻求心理健康服务的支持。

○ 实验人员已经就此研究的内容对我进行了充分的解释

○ 所有的实验过程都已被确认，并且实验人员没有向我保证我会收到任何关于我个人的结果。

○ 我有机会对项目的各个方面和所涉及到的任何过程提出问题。

○ 我自愿参与本研究，我可以在任何时候退出本研究，而不必承担任何后果，但我的数据在实验结束后将不能再被撤回，因为我的匿名数据将在这个时间点上与其他参与者的匿名数据混合在一起。

○ 我了解，同意参与这项研究意味着我允许我的匿名数据被无限期地存储在爱尔兰国立科克大学（UCC）支持的 Microsoft OneDrive 上，并存储在一个在线开放访问存储库上。如果之后的研究得到伦理审查批准，数据将可以被其使用。我们将遵循 FAIR 原则 (可查找、可访问、可互操作和可重复使用) 来使数据公开可用。

○ 我了解，如果我的参与带来了受伤的直接结果，调查人员有法律规定的保险。

○ 我了解，如果我有关于这项研究的进一步问题，我可以联系调查人员。

○ 我了解，这项研究已经得到了科克教学医院 (CREC) 临床研究伦理委员会的批准，如果我对与研究相关的权利有进一步的疑问，我可以通过电子邮件与 Lancaster Hall, 6 Little Hanover Street, Cork (CREC) 联系：crec@ucc.ie。

○ 我确认我有能力在没有协助的情况下完成问卷。

请选择下面的一个选项来决定你是否同意参加这项研究。

○ 我同意参加这项研究 (包括问卷调查和脑电图测试，关于这些我已经得到了充分解释)。

○ 我不同意，我不想参加。

参与者签名：_____

日期：_____