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Emotion Regulation Flexibility: what does it mean, and how can it be measured and improved?

Carla Nardelli

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THÈSE

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La Flexibilité de la Régulation Émotionnelle : comment la définir, la mesurer et l'améliorer ?

Emotion Regulation Flexibility: what does it mean, and how can it be measured and improved?

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Résumé long en français

La flexibilité en matière de régulation émotionnelle correspond à la capacité d'un individu à adapter ses stratégies de régulation émotionnelle en fonction du contexte dans lequel il se trouve. L'objectif de ce travail de thèse est d'étudier la place de la flexibilité dans les modèles actuels de la régulation émotionnelle, tant par sa définition conceptuelle que par son opérationnalisation et ses pistes d'amélioration à travers les interventions psychothérapeutiques.

Cette thèse sur articles est divisée en trois chapitres. À la suite d'un préambule, le Chapitre 1 vise à définir et clarifier la notion de régulation émotionnelle, de ses modèles principaux jusqu'au concept de compétences en matière de régulation émotionnelle, menant à la validation française du Questionnaire de Compétences en matière de Régulation Émotionnelle (Étude 1 – Nardelli et al., 2023).

Le Chapitre 2 aborde plus précisément la notion de flexibilité en matière de régulation émotionnelle, tant en démêlant l'hétérogénéité de ses définitions et de ses modèles qu'en présentant ses différentes opérationnalisations. Le Chapitre 2 intègre une validation française de l'Inventaire de Sensibilité au Contexte et de l'échelle de Régulation Flexible de l'Expression Émotionnelle (Étude 2 – Nardelli et al., en soumission), une revue systématique des mesures expérimentales et quotidiennes de la flexibilité (Étude 3 - Nardelli et al., en soumission) ainsi qu'une étude expérimentale sur les choix dans la régulation émotionnelle (Étude 4 – Nardelli et al., 2023).

Le Chapitre 3 se centre sur les interventions cliniques associées à l'amélioration de la régulation émotionnelle, et, plus spécifiquement, à la manière dont ces interventions (notamment l'*Affect Regulation Training*) peuvent agir sur la flexibilité en matière de régulation émotionnelle. Ce dernier chapitre se clôt par la présentation de l'Essai Contrôlé Randomisé conduit au cours de cette thèse (Étude 5 – Nardelli et al., en préparation). À la suite de ces trois

chapitres, une discussion générale est proposée afin d'intégrer les limites et l'ensemble de ce travail au regard de ses implications théoriques et cliniques.

L'introduction de la régulation émotionnelle se fait tout d'abord par une présentation des émotions. Les définitions du concept de régulation émotionnelle sont suivies par une description des classifications existantes autour des stratégies de régulation émotionnelle. Un état de l'art des modèles principaux de la régulation émotionnelle est effectué, menant à discriminer deux orientations majeures dans la discipline : les modèles basés sur les stratégies et ceux basés sur les compétences. Le Chapitre 1 se poursuit par la description du caractère transdiagnostique de la régulation émotionnelle, dont les déficits sont impliqués dans de multiples troubles psychologiques. Ces difficultés peuvent s'exprimer de différentes manières : par la surutilisation de certaines stratégies, mais également par une capacité réduite à identifier le besoin de régulation, à sélectionner une stratégie ou à l'appliquer dans une situation donnée tout en suivant l'évolution de son efficacité. Ainsi, compte tenu de l'importance de la régulation émotionnelle dans la santé mentale, la suite du chapitre est dédiée à l'exposition de questionnaires clés ayant été développés pour mesurer ce construit. Parmi ceux-ci, le questionnaire de compétences en matière de régulation émotionnelle vient répondre à certaines limites d'autres questionnaires (e.g., la mesure d'un nombre limité de stratégies ou compétences) tout en ayant été construit sur la base théorique du modèle *Adaptive Coping with Emotions* (Berking & Whitley, 2014). Ainsi, l'objectif de l'Étude 1 était de valider la version française de ce questionnaire dans une population francophone et canadienne. Les résultats de cette étude démontrent les qualités psychométriques adéquates de cet outil et soutiennent la structure en neuf dimensions de l'échelle, participant à la validation du modèle théorique *Adaptive Coping with Emotions*.

Le Chapitre 2 débute par une remise en question de la catégorisation duelle des stratégies, alors considérées comme fondamentalement adaptées ou inadaptées. En effet, la

littérature actuelle souligne l'importance du contexte dans les processus de régulation émotionnelle et se porte davantage sur la notion de flexibilité en matière de régulation émotionnelle. Un état de l'art est alors proposé rendant compte de la multiplicité des études soutenant l'hypothèse de flexibilité. Néanmoins, ce concept a été abordé par des champs variés de recherche menant à une grande hétérogénéité dans ses définitions. Après en avoir exposé les plus influentes, les modèles actuels de la flexibilité sont traités, identifiant plusieurs composantes de la flexibilité, telles que la sensibilité au contexte (identification), la notion de répertoire (variabilité et sélection des stratégies), l'application de la stratégie (implémentation) et son évaluation (monitoring et feedback). Constatant le chevauchement (du moins partiel) de ces théories, un modèle intégratif est proposé afin de connecter les différentes composantes de la flexibilité identifiées par les recherches actuelles. Une difficulté majeure dans l'évaluation de la flexibilité tient à la notion de contexte, conceptualisée et mesurée de manière variable dans les études. Une section est alors proposée afin d'illustrer différentes sources de variations du contexte, pouvant être à la fois externes (e.g., lieu, activité) et internes (e.g., âge, croyances, buts). Dans la volonté de développer des mesures de flexibilité, des questionnaires ont été construits, dont l'Index de Sensibilité au Contexte et le questionnaire de Régulation Flexible de l'Expression Émotionnelle, permettant d'évaluer deux composantes essentielles à la flexibilité décrites dans le modèle de Bonanno et Burton (2013). Ainsi, l'objectif de l'Étude 2 consistait en la validation française de ces deux questionnaires, en tant que première possibilité de mesure du construit de flexibilité. Les résultats de cette étude mettent en avant les qualités psychométriques satisfaisantes de ces échelles, permettant leur utilisation dans des populations francophones. Une réflexion autour des mesures de flexibilité est ensuite proposée, abordée à la fois par des manipulations expérimentales et des méthodes d'évaluations quotidiennes. En effet, considérant l'aspect dynamique de la flexibilité (par la covariation entre les changements du contexte et l'utilisation des stratégies qu'elle implique), de nombreuses études se tournent

aujourd'hui vers les méthodes d'échantillonnage de l'expérience, facilitant l'évaluation répétée de l'utilisation de stratégies de régulation émotionnelle ainsi que le contexte associé. Face à l'étendue de recherches tentant d'opérationnaliser la flexibilité, l'Étude 3 avait pour objectif de faire la revue systématique des méthodes expérimentales et quotidiennes utilisées pour évaluer la flexibilité en matière de régulation émotionnelle. Les résultats de cette revue ayant mis en avant l'intérêt conjoint des paradigmes expérimentaux (notamment par la sélection précise et contrôlée de sous-processus) et quotidiens (favorisant la validité écologique), l'objectif de l'Étude 4 était de répliquer et étendre un paradigme expérimental de choix de régulation émotionnelle. Les résultats de cette étude répliquent ceux des études précédentes ; les individus tendent à favoriser des stratégies de désengagement attentionnel (e.g., distraction) face à des stimuli de haute intensité et à favoriser des stratégies d'engagement attentionnel (e.g., réévaluation cognitive) lors d'une intensité plus faible. De plus, les résultats d'analyses exploratoires suggèrent une influence des compétences de régulation émotionnelle (e.g., acceptation) dans la sélection de stratégies.

Après avoir abordé les aspects théoriques et méthodologiques liés au concept et à la mesure de la flexibilité, le Chapitre 3 traite spécifiquement des interventions cliniques autour de la régulation émotionnelle. Il parcourt d'abord la capacité de différents traitements à agir sur la régulation émotionnelle, qu'elle soit explicitement ou implicitement ciblée. Parmi ceux-ci, l'*Affect Regulation Training (ART)* a été développé en adéquation avec le modèle ACE (Berking & Whitley, 2014), dans une perspective transdiagnostique. L'ART vise à l'amélioration des compétences en matière de régulation émotionnelle par une intervention groupale composée de neuf séances. Après sa présentation, son potentiel impact sur la capacité de flexibilité est argumenté, notamment sous le prisme de l'hypothèse du rôle médiateur de la flexibilité dans l'efficacité de cette intervention sur la santé mentale. Les défis associés à la mesure du médiateur, spécifiquement via l'utilisation de méthodes d'échantillonnage de

l'expérience, sont également évoqués. Le but de l'Étude 5 était ainsi de tester l'efficacité du programme ART dans un Essai Contrôlé Randomisé auprès d'une population d'étudiant·es universitaires. Précisément, l'objectif était d'évaluer son efficacité sur différents indicateurs de santé mentale (symptômes anxieux, dépressifs, compétences de régulation émotionnelle), en testant secondairement le rôle médiateur de la flexibilité au moyen de mesures répétées en vie quotidienne. Les résultats de cette étude suggèrent que le programme ART peut être efficace pour améliorer les symptômes anxieux et dépressifs, ainsi que pour renforcer les compétences de régulation émotionnelle. La collecte des données n'étant pas terminée, l'hypothèse du rôle médiateur de la flexibilité n'a pu être testée. Néanmoins, des analyses préliminaires évoquent une diminution de la variabilité dans l'utilisation de la plupart des stratégies dans le temps. Ces analyses exploratoires mettent en lumière l'importance de la distinction entre stratégies et compétences de régulation émotionnelle. En effet, les stratégies (e.g., expression émotionnelle) pourraient être davantage sujettes aux effets du contexte, comparativement aux compétences (e.g., auto-soutien) qui pourraient être plus stables à travers les contextes et le temps. Enfin, ces résultats participent au débat concernant l'adaptabilité de la variabilité (et flexibilité) de la régulation émotionnelle, faisant l'hypothèse d'une adaptabilité à mi-chemin entre une sur-variabilité (instabilité) et une sous-variabilité (inflexibilité).

La discussion générale proposée pour clore ce travail intègre les différentes études présentées au regard de la littérature récente dans le champ de la flexibilité. De plus, elle aborde les implications théoriques et cliniques de ce travail, ainsi que les limites associées. Enfin, l'ensemble de ce travail est unifié par une conclusion finale à ce travail de thèse.

Résumé court en français

Cette thèse vise à explorer la flexibilité de la régulation émotionnelle (RE) d'un point de vue théorique, méthodologique et clinique. La flexibilité de la RE, définie comme la capacité à synchroniser les stratégies de RE avec les exigences situationnelles, a été conceptualisée et opérationnalisée de différentes manières, en utilisant des méthodes corrélationnelles, expérimentales et quotidiennes. Le Chapitre 1 décrit les modèles les plus influents de la RE, ce qui nous conduit à la présentation des compétences de RE et à une validation de la version française du Questionnaire de Compétences en matière de Régulation Émotionnelle (Étude 1). Les fondements théoriques de la flexibilité sont présentés dans le Chapitre 2, dans lequel nous étudions les différentes mesures de la flexibilité. Tout d'abord, les questionnaires sont abordés, menant à une validation française de deux échelles mesurant deux composantes spécifiques de la flexibilité (i.e., sensibilité au contexte et répertoire) (Étude 2). Ensuite, les mesures expérimentales et quotidiennes sont explorées dans une revue systématique (Étude 3). Enfin, une étude expérimentale sur les choix dans la RE menée au cours de cette thèse est présentée (Étude 4). Le Chapitre 3 traite de la troisième question de cette thèse, à savoir dans quelle mesure la flexibilité de la RE peut être améliorée. Nous décrivons ainsi des interventions cliniques ciblant (explicitement ou implicitement) la RE et la flexibilité, avec un intérêt spécifique pour une intervention particulière, nommée *Affect Regulation Training* (ART). Nous avons exploré le rôle de la variabilité et de la flexibilité de la RE en menant un Essai Contrôlé Randomisé testant l'efficacité du programme ART, en utilisant une méthode d'échantillonnage de l'expérience (Étude 5). Une discussion générale tente d'intégrer les résultats dans une perspective plus large, comprenant les limites et les futures lignes de recherche sur la flexibilité de la RE.

English abstract

This thesis aimed at exploring emotion regulation (ER) flexibility from a theoretical, methodological, and clinical perspective. ER flexibility, defined as the ability to synchronise ER strategies with situational demands, has been conceptualised and operationalised in various ways, using correlational, experimental, and daily designs. Chapter 1 describes the most influential models of ER, leading us to the presentation of ER skills and a French validation of the Emotion Regulation Skills Questionnaire (Study 1). The theoretical underpinnings of flexibility are presented in Chapter 2, in which we investigate the different measures of flexibility. First, questionnaires are addressed, leading to a French validation of two scales measuring two specific components of flexibility (i.e., context-sensitivity and repertoire) (Study 2). Next, experimental and daily measures are explored in a Systematic review (Study 3). Finally, an experimental study on ER choice conducted during this thesis is presented (Study 4). Chapter 3 deals with the third question of this thesis, that is, the extent to which ER flexibility can be improved. We thus describe clinical interventions targeting (explicitly or implicitly) ER and flexibility, with a specific interest in one particular intervention, named the *Affect Regulation Training* (ART). We have explored the role of ER variability and flexibility by conducting a Randomised Controlled Trial testing the efficacy of the ART, using an experience sampling method (Study 5). A general discussion attempts to integrate findings into a broader perspective, including limitations and future lines of research in ER flexibility.

TABLE OF CONTENTS

PREAMBLE	1
CHAPTER 1. EMOTION REGULATION: DEFINITIONS AND INITIAL THEORETICAL MODELS	4
1. Emotion regulation: what is it, which strategies do we use and how can they be classified?	5
1.1. <i>Do we regulate our emotions or do we cope with our emotions?</i>	6
1.2. <i>How do we regulate and to which extent can these strategies be classified?</i>	7
2. Initial models of emotion regulation: strategy-based vs skill-based models	10
2.1. <i>Strategy-based modal model of emotion regulation</i>	10
2.2. <i>Skills/Competencies-based models of emotion regulation</i>	12
2.3. <i>Emotional goals: a key factor behind the models</i>	14
3. Emotion regulation difficulties	16
3.1. <i>Emotion regulation as a transdiagnostic process</i>	16
3.2. <i>What do we mean by emotion regulation difficulties?</i>	17
4. Measuring emotion regulation: using self-report questionnaires as a first step	18
5. Study 1: French validation of the ERSQ	22
CHAPTER 1 - CONCLUSION	47
CHAPTER 2. WHAT IS EMOTION REGULATION FLEXIBILITY AND HOW CAN IT BE MEASURED?	48
1. From emotion regulation to emotion regulation flexibility	48
1.1. <i>Is there anything that is always good or always bad?</i>	49
1.2. <i>A myriad of definitions surrounding flexibility</i>	50
1.3. <i>Current perspectives and models of emotion regulation flexibility</i>	52
1.4. <i>In the end, it all depends on the context</i>	59
2. First attempts to measure flexibility: questionnaires	62
3. Study 2: French validation of the CSI and FREE scale	66
4. Measuring emotion regulation as a dynamic process	89
4.1. <i>Experimental manipulations of emotion regulation</i>	89
4.2. <i>Daily measures of emotion regulation</i>	90
4.3. <i>Multiple indexes to account for a dynamic process</i>	92
5. Study 3: Systematic review of flexibility measures	95

6. Study 4: Experimental study on emotion regulation choice	122
CHAPTER 2 - CONCLUSION	145
CHAPTER 3. EMOTION REGULATION AND FLEXIBILITY IN CLINICAL INTERVENTIONS	146
1. Aren't all clinical interventions ultimately about emotion regulation?	147
2. The ART program: a transdiagnostic intervention on emotion regulation	150
2.1. <i>The ART skills</i>	152
2.2. <i>Evidence of the efficacy of the ART program</i>	153
2.3. <i>The potential impact on emotion regulation flexibility</i>	156
3. Considering flexibility as mediating changes in the intervention's efficacy	158
3.1. <i>Mediating role of flexibility (theoretical approach)</i>	158
3.2. <i>Challenge of measuring flexibility as a mediator</i>	160
4. Study 5: REFLEX: a RCT to test the ART's efficacy	164
CHAPTER 3 - CONCLUSION	204
GENERAL DISCUSSION	206
1. Theoretical and clinical implications	207
1.1. <i>A focus on prerequisite ER skills to be flexible</i>	207
1.2. <i>Measuring flexibility: a challenge not yet resolved</i>	213
1.3. <i>Impact of clinical interventions on flexibility</i>	217
2. Limitations	220
3. Perspectives	221
3.1. <i>On flexibility definitions</i>	221
3.2. <i>What do we need to be flexible after all?</i>	222
3.3. <i>A final thought on the pitfalls of emotion regulation research</i>	223
4. General conclusion	225
References	226
Supplementary Material	287

LIST OF TABLES

CHAPTER 1

Table 1. Emotion regulation strategies' definitions _____	9
Table 2. Psychometric properties of the questionnaires from English versions _____	19
Table 3. Psychometric properties of the questionnaires from English versions _____	21

STUDY 1: French validation of the ERSQ

Table 1. Descriptive Data _____	35
Table 2. Factor loadings, uniqueness and latent factor covariance for CFA _____	37
Table 3. Total Sample – ERSQ Descriptive Data _____	39
Table 4. Total Sample – Correlations between ERSQ Subscales and ERQ, DERS, FFMQ _____	41
Table 5. Comparisons between Diagnostic vs Non-Diagnostic Groups _____	42

CHAPTER 2

Table 1. Flexibility's definitions _____	52
Table 2. Potential contextual variability identified (from Aldao, 2013; Matthews et al., 2021) _____	62
Table 3. Psychometric properties of ER flexibility questionnaires from English versions _____	65

STUDY 2: French validation of the CSI & FREE scale

Table 1. Descriptive data _____	78
Table 2. FREE descriptive data _____	81
Table 3. Correlations between the scales for convergent validity _____	82

STUDY 3: Systematic Review of Flexibility measures

Table 1. PRISMA flow diagram of excluded and included studies in the systematic review _____	100
--	-----

STUDY 4: Experimental study on Emotion regulation choice

Table 1. Descriptive Data _____	135
Table 2. GEE logistic regression analyses predicting the probability of choosing distraction in the Replication task _____	137
Table 3. GEE logistic regression analyses predicting the probability of choosing disengagement strategies in the Extension task _____	139

CHAPTER 3

Table 1. Summary of previous studies evaluating the ART _____	155
---	-----

STUDY 5: REFLEX: a RCT to test the efficacy of the ART program

Table 1. Inclusion and non-inclusion criteria _____	169
---	-----

Table 2. Description of the ART and Relaxation sessions _____	176
---	-----

Table 3. Descriptive data _____	183
---------------------------------	-----

Table 4. Mixed models for main outcomes (i.e., BDI II, BAI, ERSQ) _____	186
---	-----

Table 5. Method 1: Mean strategy variability with Time, Group, and External and Internal Contextual Variability as predictors _____	190
--	-----

Table 6. Method 1: Goal success with Time, Group, and RMSSD as predictors _____	191
---	-----

Table 7. Method 2: Mean strategy variability with Time, Group, and External and Internal Contextual Variability as predictors _____	193
--	-----

Table 8. Method 2: Goal success with Time, Group, and Mean strategy variability as predictors ____	194
--	-----

Table 9. Comparisons between method 1 and 2 _____	195
---	-----

LIST OF FIGURES

CHAPTER 1

Figure 1. Gross’s model of Emotion Regulation process (1998) _____	11
Figure 2. Adaptive Coping with Emotions model (Berking & Whitley, 2014) _____	14

CHAPTER 2

Figure 1. The adaptability of flexibility (adapted from Aldao et al., 2015) _____	53
Figure 2. Regulatory flexibility model (adapted from Bonanno & Burton, 2013) _____	56
Figure 3. Gross’s process model of emotion regulation (adapted from Gross, 2015) _____	57
Figure 4. Summarising model on ER flexibility _____	59

STUDY 2: French validation of the CSI and FREE scale

Figure 1. Standardised factor loadings for hierarchical model of the FREE scale _____	80
---	----

STUDY 4: Experimental study on Emotion regulation choice

Figure 1. Trial procedures for both tasks _____	132
Figure 2. Violin plots for percentage of use of each strategy (Replication task) _____	136
Figure 3. Violin plots for percentage of use of each strategy (Extension task) _____	138

CHAPTER 3

Figure 1. Overview of the ART skills (adapted from Berking & Whitley, 2014) _____	153
Figure 2. ART skills target on ER processes _____	157
Figure 3. Flexibility as a hypothesised mediator _____	159

STUDY 5: REFLEX: a RCT to test the efficacy of the ART program

Figure 1. Flow chart of the study _____	174
Figure 2. Illustration of the strategy-variability operationalisations _____	181
Figure 3. Illustration of the context-variability operationalisations _____	182
Figure 4. Effect of Time, Group, and Time*Group on mental health outcomes _____	188

GENERAL DISCUSSION

Figure 1. Summarising model including ER skills from the ACE model _____	208
--	-----

PREAMBLE

Writing a thesis can be emotionally challenging and illustrates how emotion regulation flexibility can be adaptive. When I started writing, I felt anxious. But to keep moving forward, I decided to put my emotion aside and focus on my chapter. When I realised that I had lost part of my notes, I felt angry. Since I had been writing for several hours, I decided to take a break to do some sport to ease my anger. When I was doubting the quality of my thesis and felt a bit distressed, I decided to talk about it with my supervisors. When I was worrying about my thesis (i.e., and feeling anxious again) during a weekend with my sisters, I decided to suppress the expression of my emotion. Flexibly employing various strategies to deal with my emotions, depending on the situation, was probably a method that contributed to the finalisation of this thesis.

Since the 1990s, emotion regulation (ER) has been in the spotlight of psychological research. From Gross's modal model of ER (1998), many researchers have been interested in how people regulate their emotions (which ER strategies they employ) and how these processes are related to mental health outcomes (whether these strategies are more or less adaptive). Defined as a set of processes by which individuals exert control of their emotions (Gross, 1998), ER has been identified as a key process in mental health and well-being (Aldao & Nolen-Hoeksema, 2010; Hu et al., 2014). Concurrently, ER difficulties have been related to multiple psychological disorders (Aldao et al., 2010), therefore, considered a transdiagnostic process. Traditionally, ER strategies were categorised as either adaptive or maladaptive depending on their impact on mental health. For example, cognitive reappraisal was considered adaptive, whereas expressive suppression was reputed to be maladaptive (Aldao & Nolen-Hoeksema, 2012; Dryman & Heimberg, 2018). However, who has never suppressed their emotional expression of annoyance at work to ensure working relationships? Solid evidence has recently

emerged regarding the importance of context in ER. More precisely, it has been shown that different contexts can require different strategies (e.g., English et al., 2017; Sheppes et al., 2011; Troy et al., 2013). Thus, matching strategies to the environmental demands and switching strategies when needed may be essential to an adaptive ER (Bonanno & Burton, 2013). This ability refers to ER flexibility (Aldao et al., 2015), which has been associated with better mental health and well-being (Kashdan & Rottenberg, 2010; Kobylńska & Kusev, 2019).

Contextual variables can take many forms (e.g., external such as location, activity, or internal such as emotional intensity, personal goals, and values) (Aldao et al., 2015). To date, no single contextual factor has been outlined as having a unique influence on ER choice. Accordingly, authors have tested the potential influence of several contextual variables on ER, such as emotional intensity (e.g., Shafir et al., 2016; Sheppes & Meiran, 2008), controllability appraisal (e.g., Haines et al., 2016), interpersonal contexts (e.g., Hill, 2021), or goals (e.g., Argyriou & Lee, 2020; Millgram et al., 2019). Consistently, studies have demonstrated that ER choice varies depending on the context (e.g., Blanke et al., 2020). Still, to this end, diverse methodological designs have been used, such as questionnaires, experimental studies, or daily assessments. These protocols vary in the way they consider ER flexibility theoretically (i.e., through a large repertoire of strategies, variability in terms of strategies use, or through different ER choices facing different contexts). So far, no consensus has been established regarding the best method to capture ER flexibility or the best way to define this concept. As such, current literature does not provide clear evidence regarding which aspects of flexibility are associated with mental health or how to improve this ability specifically.

If ER flexibility can be deemed a major variable towards efficient ER, enhancing it through clinical interventions is of major relevance. At the same time, authors have underlined the importance of detecting processes that mediate the effect of an intervention on mental health (e.g., Hofmann & Hayes, 2019). In this perspective, flexibility in using ER strategies emerges

as a promising mediating factor of ER interventions. Unfortunately, most ER clinical interventions limit their evaluation to self-reported pre- and post-measures, preventing us from exploring ER dynamics, the role of context, and the processes underlying the intervention's effect. Daily measurement, such as the Experience Sampling Method (ESM), is a promising tool to measure ER dynamics by considering several contextual factors as well as individuals' ER choices on a daily basis (Csikszentmihalyi & Larson, 2014). Hence, the general purpose of this thesis is to precisely examine ER flexibility's theoretical background, as well as how it can be measured and improved by clinical interventions.

STRUCTURE OF THE MANUSCRIPT

Both theoretical, methodological, and clinical features are challenging for ER flexibility research. Subscribing to a transdiagnostic and processual approach, the present dissertation is divided into three chapters, each including the related studies conducted during the thesis.

Since each study addresses precise aspects of the thematic, we decided to structure the dissertation accordingly. To approach ER flexibility, we first need to lay some foundations on emotions and ER models, which is targeted by the first Chapter, leading to Study 1 (French validation of the Emotion Regulation Skills Questionnaire). The second Chapter focuses on ER flexibility's definitions and measurement issues that drove Study 2 (French validation of the CSI and FREE scale), Study 3 (Systematic review), and Study 4 (Experimental study on ER choice). The third chapter addresses ER clinical interventions and presents the preliminary results of Study 5 (REFLEX: A Randomised Controlled Trial). After these main sections, we discuss the different results in light of the literature to answer the goals of this thesis. **All supplementary materials are attached to this manuscript.**

CHAPTER 1. EMOTION REGULATION: DEFINITIONS AND INITIAL THEORETICAL MODELS

A plurality of terms is employed when conceptualising what an individual can feel or experience, such as *emotion*, *affect*, or *mood*, which can lead to a ‘conceptual and definitional chaos’ (Buck, 1990, p.330). *Affect* is often considered an umbrella term comprising *emotion*, *stress*, and *mood* (Gross, 2013). *Stress* and *emotion* have been distinguished by their valence (i.e., *stress* refers to negative affective responses, whereas *emotion* can relate to positive responses as well) (Lazarus, 1993). In turn, *emotion* and *mood* can be differentiated by their duration. Indeed, *mood* alludes to a longer time of experience and less specific states (Lang, 1995; Larsen et al., 2008). *Feeling* is also used interchangeably with *emotion*. Some authors consider a difference in that *emotion* implies impulses to act while *feeling* does not (Frijda, 1986; Izard, 1990). In this thesis, we will be talking about *emotion*, as used in the emotion regulation research field, including the management of both positive and negative responses (Nezlek & Kuppens, 2008).

Emotion is commonly defined as a multidimensional construct comprising changes in physiology, subjective experience, cognition, and behaviour that unfold over time and occur in response to an activating event (Mauss et al., 2005). A core feature of *emotion* is that it involves the individual’s awareness and appraisal of a stimulus (Gross, 1998; Lazarus, 2001; Scherer et al., 2001). In other words, an emotion arises after an individual has encountered an emotionally-relevant stimulus, directed their attention towards it, appraised and interpreted the stimulus to give rise to an emotional response, whether consciously or automatically (Fernandez et al., 2016; Gross & Jazaieri, 2014; Lazarus, 1991). Overall, *emotion* can be understood as a signal that informs us of external or internal salient stimulus (Kobylińska & Kusev, 2019) that pushes us to act. The functional aspect of emotions has been studied for a long time, showing that

emotions serve purposes and are self-regulatory (e.g., sadness can elicit social support; fear can elicit prudence), both at intrapersonal and interpersonal levels (Frijda & Mesquita, 1994; Keltner & Gross, 1999), as addressed under the evolutionary perspective (Cosmides & Tooby, 2000; Darwin, 1892; Frijda, 2016). An emotional reaction can be expressed by several channels, such as thoughts, biological modifications, tendencies to action, expressive and behavioural modifications, or subjective experience (Scherer et al., 2001).

At times, when the emotion itself is evaluated as not congruent with desired states and/or goals, a regulation process can arise, consciously or less consciously (Gross, 1998). Thus, emotion regulation appears when emotions are not functional anymore (Gross, 2008; Parrott, 1993).

This chapter will first present the generalities of emotion regulation. Next, we will describe initial models that propose several perspectives on the emotion regulation process. After a theoretical presentation, this chapter will end with the first study of this thesis, i.e., a French Validation of the Emotion Regulation Skills Questionnaire.

1. Emotion regulation: what is it, which strategies do we use and how can they be classified?

Emotion regulation (ER) has been defined diversely (Bloch et al., 2010), most commonly as a set of processes by which people exercise control over the nature and intensity of their emotions (Gross, 1998). Even if part of ER often takes place consciously (Gross, 1998), others claim that these processes can also be automatic (e.g., Braunstein et al., 2017; Koole et al., 2011). This has led to a specific definition for implicit ER: ‘any process that operates without the need for conscious supervision or explicit intentions, and which is aimed at modifying the quality, intensity, or duration of an emotional response’ (Koole et al., 2011, p.390). Whereas some conceptualisations describe a dual process that distinguishes implicit and explicit ER

(e.g., Gyurak et al., 2011), others propose that the dichotomisation is porous (Koole et al., 2011). Importantly, this perspective engages a dynamic view of ER that can be composed of both implicit and explicit processes. As such, it seems preferable to consider the conscious and non-conscious ER processes along a continuum (e.g., Gross, 1999a).

1.1. Do we regulate our emotions or do we cope with our emotions?

ER overlaps with the concept of stress coping, defined as ‘constantly changing cognitive and behavioural efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person’ (Lazarus & Folkman, 1984, p.141). The main distinction between the two concepts relies on the fact that ER would only concern the regulation of inner reactions (e.g., physical sensations or thoughts), whereas coping would relate to regulating both internal and external aspects (e.g., changing the situation) (Wang & Saudino, 2011). However, current models of ER (e.g., Gross, 2015) also integrate ER strategies targeting external aspects (e.g., problem-solving, expressive suppression). From this perspective, coping and ER are hardly distinguishable.

Another distinction formulated is that ER focuses on both negative and positive emotions, whereas coping mainly deals with negative emotions or non-emotional actions (Gross, 1999a; Scheier et al., 1986). Even though coping has been initially described in association with stressful situations in health psychology, its processes can be applied to other kinds of emotions. Components of coping are described through a three-factor model, including problem-focused (e.g., problem-solving), emotion-focused (e.g., emotional expression), and appraisal-focused (e.g., cognitive reappraisal) strategies (Pearlin & Schooler, 1978). This model echoes those of ER (i.e., affect modulation and appraisal processes) (e.g., Gross, 1998; Wang

& Saudino, 2011). Considering the difficulties in clearly separating these two terms, some authors use them interchangeably (e.g., Kobylińska & Kusev, 2019).

A final proposition by John and Eng (2014) considers the term ‘affect regulation’ as a superordinate concept comprising ER, stress coping, and emotional skills. In this model, the authors also distinguish ER from coping, the latter being focused on negative stimuli only and lasting longer periods of time (e.g., coping with bereavement). In sum, coping has been considered as a broader category that targets non-emotional actions (Gross, 1999b). Since the early 20th century, the way individuals manage their emotions has been investigated variously, mainly through the stress and coping theory (Lazarus, 1966), which was expanded to the ER field in the 1990s. In this thesis, we will focus on conceptualisations of ER processes, even though we acknowledge that parts of them result from coping theories.

1.2. How do we regulate and to which extent can these strategies be classified?

People try to influence their emotional experiences through the use of various strategies (i.e., ER strategies), from escaping a situation to practising relaxation, for example. People often engage in more than one strategy at a time and/or over time (e.g., Aldao & Nolen-Hoeksema, 2012; Ford et al., 2019), which highlights the complex and temporal processes behind ER. Even if the most common form of regulation is to down-regulate the intensity of an emotion, sometimes individuals try to up-regulate or maintain a stable response over time (Koole & Aldao, 2016). The number of strategies is almost infinite, given that any behavioural or cognitive action an individual engages in to modify the emotional impact can be considered as such (Koole, 2010).

These strategies have often been categorised as either adaptive (e.g., cognitive reappraisal) or maladaptive (e.g., rumination) (Aldao et al., 2010), given their association with

mental health outcomes (for a meta-analytic review, see Webb et al., 2012). Overall, adaptive strategies have been associated with better outcomes when compared to maladaptive strategies that have been shown to be more consistently associated with psychopathology (Gross & Jazaieri, 2014; Hu et al., 2014). For example, maladaptive strategies (e.g., suppression) have been associated with high anxiety (Campbell-Sills et al., 2014), while adaptive strategies (e.g., cognitive reappraisal) have been associated with adaptive outcomes, such as a reduction in the experience of negative affect (Goldin & Gross, 2010). See a list of commonly described ER strategies in Table 1.

Researchers have recently tried categorising strategies in larger families depending on their possible common underlying factors, i.e., ‘underlying, unobservable latent variable thought to be responsible for the interrelations among a set of variables’ (Hancock & Mueller, 2013, p.2). Some have proposed to distinguish cognitive or covert strategies (e.g., rumination, acceptance) from behavioural or overt strategies (e.g., substance use, social activities) (Aldao & Dixon-Gordon, 2014; Parkinson & Totterdell, 1999). Another influential categorisation was based on the different time points on which strategies can intervene, describing antecedent-focused strategies that occur before the emotional response (e.g., avoidance) or response-focused strategies (e.g., expressive suppression) (Gross, 1998). Overall, studies have failed to identify common underlying factors, whether comparing single-factor or multiple-factor models (Seligowski & Orcutt, 2015). In their meta-analysis, Naragon-Gainey et al. (2017) confirmed the difficulty of studying the structure of ER strategies by demonstrating that each previously hypothesised structure poorly fitted to the data (i.e., one-factor, adaptive vs maladaptive, cognitive vs behavioural). These findings underline that no structure has been identified yet.

Table 1*Emotion regulation strategies' definitions*

Strategy	Definition
Cognitive reappraisal	'Cognitive change that involves changing the subjective interpretation of an emotion-eliciting event in a way that alters its emotional impact' (Gross & John, 2003)
Expressive suppression	'A conscious inhibition of expressive or behavioural component of an emotion' (Dan-Glauser & Gross, 2013)
Problem-solving	'Orientation or specific actions directed at solving a problem, e.g., brainstorming solutions, planning a course of action' (Blanchard-Fields, 2009)
Social support	'Openly talking with someone else about the circumstances and/or emotional reactions to a particular emotion-eliciting event' (Rimé, 2009)
Substance-use	'Regulating emotion by pharmacologically altering one's current state' (Kober, 2014)
Distraction	'Focusing attention on other aspects of the situation or moves attention away from the situation may involve changing internal focus' (Gross, 2013)
Acceptance	'Ability to remain in contact with feelings, thoughts and physical sensations, without attempting to change them or manipulate them in any way' (Hayes et al., 1999)
Tolerance	'Intentionally permitting negative emotions to be present for the amount of time necessary for them to change, since fighting against emotions is likely to make them even stronger' (Berking & Whitley, 2014)
Rumination	'Repetitively focusing on their experience of the emotion and its causes and consequences' (Nolen-Hoeksema et al., 2008)
Relaxation	'Directly influencing experiential, behavioural, or physiological components of the emotional responses through techniques such as physical exercise or deep-breathing relaxation' (Gross & Jazaieri, 2014)
Self-support	'Mental or behavioural activities that help keep one's mood within the window of tolerance' (Berking & Whitley, 2014)
Experiential avoidance	'Seeking to escape internal thoughts, images, feelings, and sensations' (Hayes et al., 1999)

2. Initial models of emotion regulation: strategy-based vs skill-based models

In the 1990s, two main approaches emerged to describe ER processes. While the first focuses on strategy-based models, the second has been interested in exploring more dispositional abilities through skill-based models.

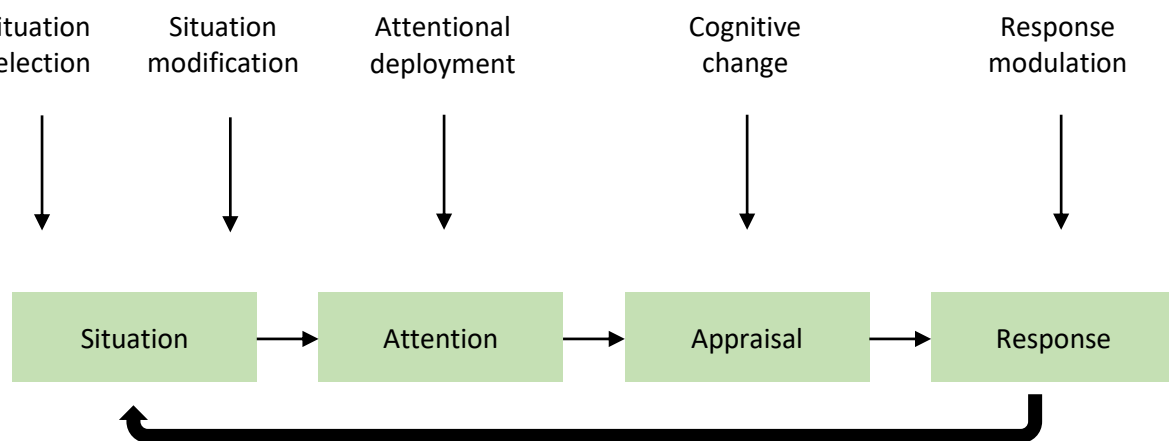
2.1. *Strategy-based modal model of emotion regulation*

In 1998, James J. Gross developed their influential ER modal model, classifying strategies by the time they can arise in the ER process. The model describes different temporal steps throughout the emotion-generative process during which one can attempt to regulate emotions through specific ER strategies (antecedent-focused vs response-focused strategies). First, *situation selection* allows one to avoid or approach situations that can elicit emotions (e.g., avoiding a stressful meeting). In this category, individuals regulate their anticipatory emotion in a preventive perspective. Then, the stage of *situation modification* is depicted, during which one can alter an aspect of the situation to modify its emotional impact by modifying some parameters of the situation (e.g., hiding a mistake). Next is a phase of *attentional deployment* where one can selectively direct their attention towards or away from the stimulus. The best example of this category is distraction, which can refer to focusing on non-emotional aspects of the situation (e.g., looking behind the stimulus) or on any other material external to the situation (e.g., engaging in an activity such as reading) (Nix et al., 1995). Rumination can also be included in this category, referring to an attentional focus on the situation, thoughts, or behaviours related to it. Subsequently, the *cognitive change* stage refers to attempts to regulate one's emotion by altering the meaning of the stimulus by reappraising it. Cognitive reappraisal is often considered the best strategy (e.g., Gross, 1998), associated

with fewer negative states and better well-being (e.g., John & Gross, 2004). The last category of *response modulation* describes strategies that aim to decrease, increase, or maintain emotional responses, in which one can influence the already made response. This category includes various strategies that can alter the physiological component of emotion (e.g., drug consumption, relaxation) or behavioural component (e.g., suppression of emotional expression) (see Figure 1).

Figure 1

Gross's model of Emotion Regulation process (1998)



This model and its reformulations (e.g., Gross & Thompson, 2007) have allowed for measuring precisely each step of the ER process and comparing the impact of various strategies on different outcomes. However, this model limits the understanding of ER as a dynamic process by depicting a relatively linear model providing only information on the temporality of the strategies' occurrence. The dual classification of strategies (antecedent vs response focused) has been considered as an oversimplification omitting that strategies based on the antecedent often arise during or after the emotional response (e.g., reappraising physical sensations), and, in turn, response-focused strategies can be applied before the emotional response (e.g.,

anticipating an event by practising relaxation) (Philippot, 2011). Moreover, this model postulates that antecedent-focused strategies are more adaptive, although it has been challenged by research showing that they are sometimes associated with negative consequences (e.g., avoidance, Barlow, 2002). Since the model has been mostly focused on reappraisal and expressive suppression, it seems difficult to generalise to other strategies.

A major subfield of ER has been dedicated to investigating ER processes through larger abilities (i.e., skills, competencies) that can help individuals adaptively regulate their emotions. A range of authors has been interested in studying these skills, for example, under the emotional intelligence perspective.

2.2. Skills/Competencies-based models of emotion regulation

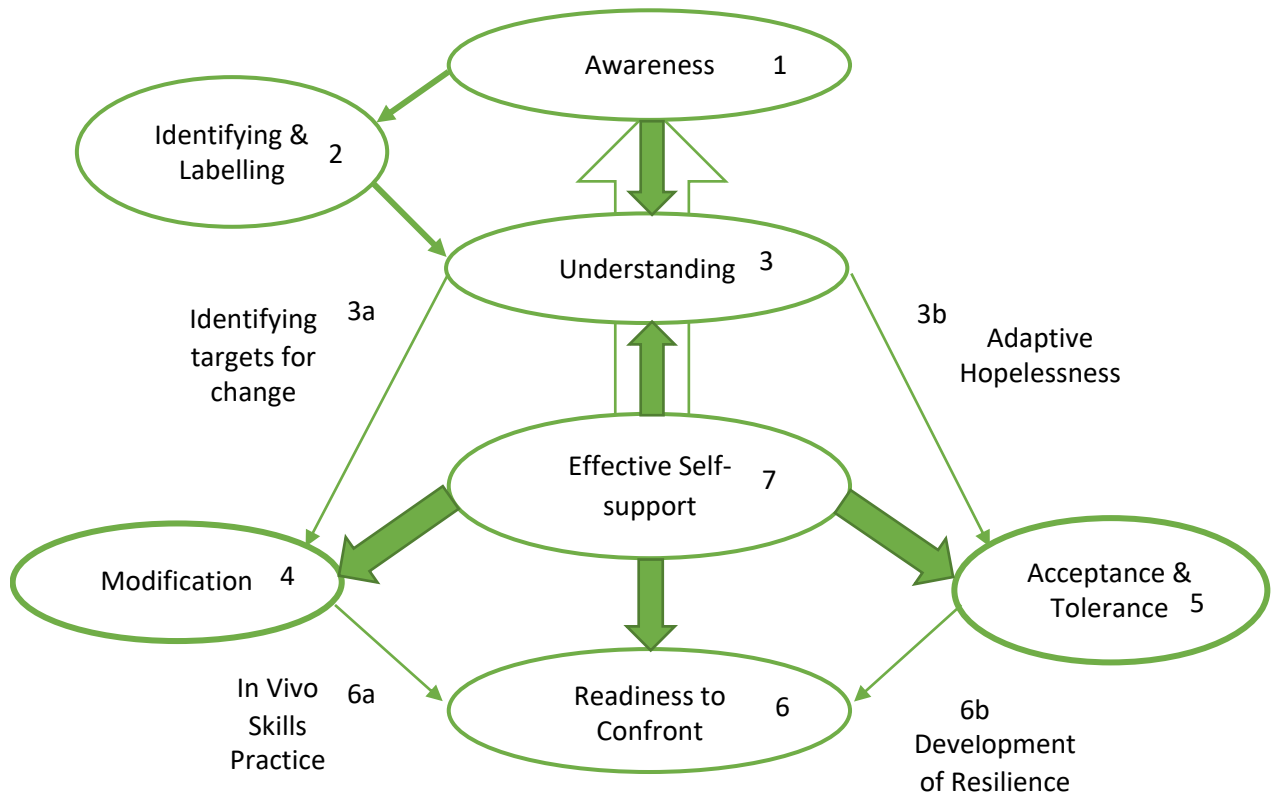
Emotional intelligence (EI) is defined as a set of competencies that differ among individuals and can characterise their ER style (Peña-Sarrionandia et al., 2019), such as the ability to *perceive, understand, express, use, and manage* emotions (Mayer et al., 1997; Peña-Sarrionandia et al., 2019). Mikolajczak et al. (2009) modelled EI based on three connected levels. First, the *knowledge* describes what people know about emotions and emotional skills (e.g., ‘I know that reappraisal can be effective’). Second, they mention the *ability* to apply the knowledge in a situation (e.g., ‘I am able to reappraise when needed’). Third, *traits* refer to emotional dispositions in the way people habitually act in response to their emotions (e.g., ‘I often use reappraisal’) (Mikolajczak, 2009). In a recent meta-analysis (2019), Peña-Sarrionandia et al. propose to unify both the EI and ER research traditions under the perspective of Gross’s model (1998) towards a processual conception of EI. Their results indicate for instance that high EI individuals use fewer avoidant strategies due to their knowledge about the long-term benefits of confronting difficult situations. Overall, their results indicate that

individuals with high EI are able to shape early their emotional trajectory. In other words, *knowledge*, *ability*, and *traits* levels have been found to be associated with more adaptive ER (Peña-Sarrionandia et al., 2019).

Berking et al. (2014) have adopted a similar perspective by focusing on ER skills rather than ER strategies. They developed the Adaptive Coping with Emotions model (ACE), which schematises adaptive ER as the interplay between several ER general skills: (a) the awareness of one's emotional experiences; (b) the ability to identify and correctly label perceived emotions; (c) the ability to interpret body sensations correctly; and, (d) the understanding of the circumstances that may have led to and maintained those emotions. Moreover, ER skills also include (e) the ability to modify the intensity or duration of one's emotions; (f) to accept and tolerate unwanted emotions; (g) to confront certain situations; and, finally, (h) to be able to provide self-support (e.g., self-compassion) (see Figure 2). The model leads to consider that acceptance, tolerance, and emotion modification are key competencies and the other transversal skills facilitate their application (for a more detailed description, see Chapter 3, p.150). One possible way to integrate both strategy-based and skill-based models is to explore potential bidirectional effects between strategies and skills (Naragon-Gainey et al., 2017). Considering them complementary, ER skills would facilitate the implementation of both 'adaptive' and 'maladaptive' strategies when the use of ER strategies would stimulate or reduce ER skills (e.g., repetitive avoidance would decrease the ability to be aware of one's emotion) (Aldao & Tull, 2015; Tull & Aldao, 2015).

Figure 2

Adaptive Coping with Emotions model (Berking & Whitley, 2014)



2.3. Emotional goals: a key factor behind the models

When our needs and goals are threatened, emotional reactions are generated to push us to act in the direction of our goals (Scherer, 2009). As Gross reminds us, an emotion does not always need to be regulated: it only does when it interferes with current goals (2015), i.e., when the generated emotion is not congruent with our goals. Trying to regulate one's emotions implies that an emotional goal has been additionally activated (Gross, 2015; Tamir et al., 2020). Hence, an ER strategy can be understood as an action (or set of actions) implemented to reach a goal (Gross, 2002) and, as such, various goals can imply diverse strategies. To illustrate, a

goal of increasing an emotion should foster engagement strategies (e.g., rumination), whereas aiming at decreasing an emotion should involve disengagement strategies (e.g., distraction).

This vision is not new in the field: coping theory has already mentioned the individual's appraisal of threatened goals as essential (Folkman & Moskowitz, 2004). Emotional goals have been defined as representations of desired emotional states (Mauss & Tamir, 2014). Individuals engage in an ER strategy for a reason, whether hedonic (e.g., to decrease negative emotion), instrumental (e.g., to finish a task), or social (e.g., to influence social interactions or relationships) (Eldesouky & English, 2019; Kobylińska & Kusev, 2019; Tamir, 2009, 2016). A hierarchy in these goals has been identified, separating concrete desired end-states (emotion goals) from more abstract ones (Carver & Scheier, 2013). Subordinate goals can reflect what people want in the situation and superordinate why they want it (McClelland, 1985; Tamir, 2016). As such, people tend to pursue subordinate desired emotion states (ER goal) that serve superordinate ones (ER motives) that can be both hedonic or instrumental (e.g., performance, epistemic, social, etc). In other words, lower-order goals (*means* or ER goals, e.g., feeling less anxious) can be activated by higher-order goals (*motives* or superordinate goals, e.g., giving a good speech) (Tamir et al., 2020).

Furthermore, Tamir et al. distinguish goal *setting* from goal *striving*, the first referring to a selection of an end-state to achieve and the latter to an engagement in behaviours to achieve desired end-state (2020). In line with the activated emotional goal, ER would arise through actions directed to transform the current emotion towards a more desired one. After an emotional goal has been activated, different processes take place: choosing one or several strategies, implementing it, and monitoring whether its application is efficient according to the initial goal (Gross & Jazaieri, 2014).

3. Emotion regulation difficulties

3.1. *Emotion regulation as a transdiagnostic process*

Difficulty in ER is currently considered a transdiagnostic factor (Aldao et al., 2010; Cludius et al., 2020; Lincoln et al., 2022; Sloan et al., 2017). The transdiagnostic approach focuses on processes that exist across a range of disorders and causally contribute to the development and/or maintenance of psychopathology (Harvey et al., 2004). It has been shown that ER difficulties are associated with depression (Ehring et al., 2010; Joormann & Siemer, 2014; Joormann & Stanton, 2016), anxiety (Campbell-Sills et al., 2014; Mennin et al., 2009; Tull et al., 2007), eating disorder (Lavender et al., 2015), substance use/abuse (Nandrino et al., 2021), posttraumatic stress disorder (Frewen & Lanius, 2006), and borderline disorder (Crowell et al., 2009). Indeed, the large majority of mental health difficulties involve undesired emotional states and/or dysfunctional attempts to avoid undesired emotions (e.g., binge eating, self-harming behaviour, psychotic symptoms, etc.) (Berking & Lukas, 2015).

Considering emotions and ER disturbances as transdiagnostic, some authors have proposed to define *emotional disorders* through three characteristics, namely: (1) the experience of frequent and intense negative emotions, (2) an aversive reaction to the emotional experience itself, and (3) efforts to dampen, escape, or avoid the emotional experience (Bullis et al., 2019). In other words, emotional disorders are characterised by difficulties in ER (e.g., the constant use of strategies such as distraction). Even though emotional disorders commonly refer to anxiety and depressive disorders, they expand to other classified disorders, such as borderline personality disorder, eating disorder, and insomnia disorder (Bullis et al., 2019; Moses & Barlow, 2006). To illustrate the focus on ER as a transdiagnostic process, some authors have

even proposed to integrate it as a new domain of the Research Domain Criteria (RDoC) classification (Fernandez et al., 2016; Sun et al., 2017).

3.2. What do we mean by emotion regulation difficulties?

While some authors have argued that ER difficulties refer exclusively to the implementation of ‘maladaptive’ ER strategies (Cicchetti et al., 1995), others have suggested that ER deficits could encompass different specific issues. Fernandez et al. (2016) separate difficulties in identifying, selecting, implementing ER strategies, and monitoring one’s emotions. For example, an individual could identify correctly their emotion of anger but could hardly calm down with relaxation. Another individual could also identify anger and be able to apply relaxation but could deal with difficulties in changing strategies when the former is no longer effective. Emotion dysregulation can also include limited use of adaptive strategies or overuse of maladaptive ones (Cludius et al., 2020; Kring & Sloan, 2009). For example, an individual could persist in applying distraction at any emotional occasion, preventing them from tolerating emotions when it would be the more adaptive option.

Whether the individual has difficulties in ER or not, this process takes place when the initial emotional response (e.g., anger) is evaluated as requiring a modification (e.g., decreasing its intensity) to match a desired state or goal (e.g., if being angry does not suit the professional context) (Gross, 2015). Indeed, the difference between emotion generation and regulation appears functional: if an emotional experience is the result of the valuation of an – external or internal – stimulus (e.g., being angry at a co-worker), ER arises from the valuation of this initial valuation (as a meta-evaluation) to give place to another response (e.g., ‘I should not display my anger at work’ thought could lead to expressive suppression) (Gross & Jazaieri, 2014).

4. Measuring emotion regulation: using self-report questionnaires as a first step

Consistent with the transdiagnostic perspective on ER difficulties, several questionnaires have been developed to precisely examine ER. Indeed, questionnaires have numerous advantages, such as their ease of administration and rapid dissemination. The first set of them targets ER strategies, postulating that using more adaptive strategies (e.g., acceptance, reappraisal) would be associated with better outcomes.

The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) has been designed to study inter-individual differences in ER and evaluates both ‘adaptive’ and ‘maladaptive’ strategies. It specifically measures emotional expressive suppression (i.e., the inhibition of emotional response, 4 items; e.g., *‘When I am feeling negative emotions, I make sure not to express them’*) and cognitive reappraisal (i.e., the reappraisal of the situation to decrease or increase its emotional composition, 6 items; e.g., *‘I control my emotions by changing the way I think about the situation I am in’*). Each item is measured using a Likert scale ranging from 1 ‘strongly disagree’ to 7 ‘strongly agree’.

Another often-used measure is the Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski et al., 2001), which focuses on cognitive strategies that individuals can usually apply facing negative or unpleasant events. Each item is evaluated with a Likert scale ranging from 1 ‘almost never’ to 5 ‘almost always’. This questionnaire is divided into dimensions categorised as ‘non-adaptive regulation’ (i.e., self-blame, rumination, dramatisation, other-blame) and ‘adaptive regulation’ (i.e., acceptance, positive centration, action centration, cognitive reappraisal, putting into perspective). The main limit of this scale is that it only measures the cognitive aspects of ER. This is a main issue because behavioural strategies are also considered central in the ER literature (Mauss et al., 2005). Additionally, the original validation study did not provide information on convergent validity, i.e., correlational

analyses between the scale and other measures of the same construct. See Table 2 for a description of the two questionnaires' properties.

Although this first set of questionnaires allows us to measure the general frequency of strategy-use, they are limited by the assessment of only a few strategies.

Table 2

Psychometric properties of the questionnaires from English versions

Scales	Scale alpha	Items	Subscales	Subscales Alphas	Trr	Convergent validity
ERQ	-	10	Reappraisal	.79	.69 ¹	.30*
			Suppression	.73		-.22*
			Self-blame	.73		-
			Acceptance	.66		-
			Rumination	.81		-
CERQ	.92	36	Positive refocusing	.66	.64*	-
			Refocus on planning	.81		-
			Positive reappraisal	.74		-
			Putting into perspective	.74		-
			Catastrophising	.72		-
			Blaming others	.71		-

Note. *: $p < .05$; Convergent validity of the ERQ was explored with the NMR (Generalised Expectancy for Negative Mood Regulation Scale; Catanzaro & Mearns, 1990). Trr: test-retest reliability.

The second set of questionnaires has been developed according to the ER competencies/skills perspective. One of the most widely used is the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) that evaluates ER difficulties through 6 dimensions: non-acceptance of emotional response, difficulty engaging in goal-directed

¹ The associated p -value was not indicated in Gross's paper.

behaviours, difficulty controlling impulses, lack of emotional awareness, limited access to ER strategies, and lack of emotional clarity. Each item is assessed with a Likert scale ranging from 1 ‘*almost never*’ to 5 ‘*almost always*’. One limit of this questionnaire is that it evaluates deficits in ER and mainly focuses on one type of situation, i.e., ‘*when I’m upset...*’ (for 27 of the 36 items of the questionnaire), concentrated on negative emotional states. Therefore, this scale is in little agreement with new models of ER (e.g., Berking et al., 2010) that reinforce the importance of interaction between strategies and highlight ‘general’ skills associated with an improvement of mental health (Berking & Lukas, 2015). Lastly, the ability to properly identify the emotion’s trigger is not evaluated, thus preventing context from being taken into account.

Similarly, the Emotion Regulation Skills Questionnaire (ERSQ; Berking & Whitley, 2014) has been elaborated by Berking and collaborators. Initially developed in German (SEK-27; Berking & Znoj, 2008), the current version of this questionnaire measures 9 ER skills defined by Berking and Whitley (2014): emotional awareness, sensations, clarity, understanding, emotions modification, acceptance, tolerance, confrontation of situation, and self-support. Each item is evaluated with a 5-point Likert scale ranging from ‘*not at all*’ to ‘*almost always*’, referring to the past week. Several studies have shown an association between these skills and different indicators of mental health (Berking et al., 2013; Berking & Lukas, 2015; Radkovsky et al., 2014). The test-retest reliability for all subscales was low, although it is not surprising since the skills are supposed to be sensitive to changes in context, possibly changing from one week to the next in accordance with the instructions given (i.e., ‘In the last week’). Contrary to the DERS, the ERSQ is the only questionnaire to assess all the skills described in the ACE model by focusing on abilities instead of difficulties. See Table 3 for a description of the two questionnaires’ properties.

Table 3*Psychometric properties of the questionnaires from English versions*

Scales	Scale alpha	Items	Subscales	Subscales Alphas	Trr	Convergent validity
DERS	.93	36	Non-acceptance	.85	.88*	-.42*
			Goals	.89		-.53*
			Impulse	.86		-.46*
			Awareness	.80		-.34*
			Strategies	.88		-.69*
			Clarity	.84		-.39*
ERSQ	.96	27	Awareness	.76	.60*	.35*
			Sensations	.75	.49*	.41*
			Clarity	.85	.43*	.47*
			Understanding	.85	.48*	.40*
			Acceptance	.79	.53*	.56*
			Tolerance	.88	.59*	.50*
			Confrontation	.77	.46*	.42*
			Self-support	.73	.30*	.50*
			Modification	.74	.47*	.56*

Note. *: $p < .01$; Convergent validity of the DERS and ERSQ was explored with the NMR (Generalised Expectancy for Negative Mood Regulation Scale, Catanzaro & Mearns, 1990). Trr: test-retest reliability.

Given the promising qualities of the ERSQ, the first goal of this thesis was to validate its French version in international collaboration (McGill University, Canada). The manuscript of this research is presented in the next section.

5. Study 1: French validation of the ERSQ**French validation of the Emotion Regulation Skills Questionnaire².**

This article is in press in the European Review of Applied Psychology

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Preregistration, data, material, and supplementary material: <https://osf.io/hpy3v/>

² This version of the article was adapted to avoid repetitions with the Chapter.

Abstract

Background. ER has become the target of multiple clinical interventions, given its transdiagnostic features. The goal of this study was to validate a French version of the Emotion Regulation Skills Questionnaire (ERSQ, Berking & Znoj, 2008), which provides an overview of the ER skills described in the Adaptive Coping with Emotions model. Method. This online study consisted of different questionnaires designed to analyse the psychometric properties of the ERSQ in both French and Canadian non-clinical populations (N=658). Results. The nine subscales based on the nine factors show a satisfactory internal consistency. The scale also demonstrates good convergent validity and acceptable test-retest validity. The proposed nine-factor model shows an adequate fit to the data, with all approximate fit indices showing acceptable model fit. Limitation. This online study can be associated with common limits of self-reported measures. Moreover, our results should be replicated in future studies, for example in clinical samples, to validate its discriminant capacity. Conclusions. The French version of the ERSQ can be considered as a reliable instrument for assessing ER skills. Contrary to other related questionnaires, the ERSQ measures multiple dimensions considered as possible targets of psychological interventions.

Keywords: emotion regulation, assessment, validity, reliability, emotion regulation skills.

Introduction

In order to assess the efficacy of interventions targeting ER, standardised and valid measures of ER are needed. Researchers have relied on various measures to assess ER skills, and some of these scales have already been translated into French (e.g., ERQ, Gross & John, 2003; DERS, Gratz & Roemer, 2004). Nevertheless, the availability of scales measuring ER is scant given that they often assess a limited set of ER skills. Therefore, the currently available scales in French fail to incorporate key hallmarks and dimensions of ER, which precludes them from being considered valid measures of current and theory-driven models of ER (e.g., Berking et al., 2010) that explain the protective role of ER on mental health (Berking & Whitley, 2014; Berking et al., 2008; Naragon-Gainey et al., 2017; Wirtz et al., 2014).

The Emotional Regulation Skills Questionnaire (ERSQ, Berking & Znoj, 2008) was developed in congruence with the ACE model and is the only available measure to assess the following skills and, therefore, better understand their interactions. The questionnaire assesses (1) *awareness* (e.g., ‘I paid attention to my feelings.’), (2) *sensations* (e.g., ‘My physical sensations were a good indication of how I was feeling’), (3) *clarity* (e.g., ‘I was clear about what emotions I was experiencing.’), (4) *understanding* (e.g., ‘I was aware of why I felt the way I felt.’), (5) *modification* (e.g., ‘I was able to influence my negative feelings.’), (6) *acceptance* (e.g., ‘I accepted my emotions.’), (7) *tolerance* (e.g., ‘I felt I could tolerate my negative feelings.’), (8) *confrontation* (e.g., ‘I did what I had planned, even if it made me feel uncomfortable or anxious.’), (9) *self-support* (e.g., ‘I supported myself in emotionally distressing situations.’). Initially developed in German (SEK-27: Selbsteinschätzung emotionaler Kompetenzen-27, Berking & Znoj, 2008), this initial version of this questionnaire assessed a person’s ability to apply ER skills in the last week and had good psychometric properties: Cronbach’s alpha for the total scale was = .90, convergent validity was explored using other ER questionnaires such as the Difficulties of Emotion Regulation Scale, the

Negative Mood Regulation Scale, ($p < .001$), and test-retest reliability was explored at 4 weeks interval ($r = .45 - .61$). Also, exploratory factor analysis from the initial version of the scale revealed a five-factor solution, but their confirmatory factor analyses favoured the nine-factor solution (CFI = .88, RMSEA = .066, $p < .001$) rather than the five-factor solution (CFI = .81, RMSEA = .085, $p < .001$).

The questionnaire was subsequently translated into English by Grant et al. (2018), but also in Japanese (Fujisato et al., 2017), in Czech (Klocek et al., 2022), in Latvian (Kristina-Everte et al., 2021), in Turkish (Vatan & Kahya, 2018), and in Spanish (Aguilera-Reyes et al., 2021). These validation studies also displayed good psychometric properties, supporting the validity and reliability of the measure. For example, the English-translation Cronbach's alphas ranged from .73 to .88; convergent validity was explored using other ER questionnaires as well as loss of well-being and psychopathology scales (e.g., Depression and Anxiety Stress Scale) ($p < .05 - p < .001$), and test-retest was explored at 3 weeks interval ($r = .30 - .60$). Overall, the psychometrics properties of the scale were good, and the factorial analyses of the English version supported the nine-factor solution (CFI = .90, RMSEA = .07, $p < .001$). The nine-factor solution was also confirmed in other validation studies (e.g., Aguilera-Reyes et al., 2021).

Moreover, another strength of the validation studies lies in the fact that this questionnaire has been used to measure ER and these studies have shown that the applied skills assessed by the self-assessment were significantly associated with different mental health indicators (Berking et al., 2013). For example, it has been found that ER skills assessed with the ERSQ predicted the reduction of depressive symptoms in patients with major depressive disorder (Fujisato et al., 2017; Radkovsky et al., 2014).

Therefore, given the need for ER measures and previous studies attesting to good psychometric proprieties of the ERSQ, the present study aims to validate a French version of this scale. It was also key for the translation validity procedure to include European French as

well as North American French since they vary primarily in terms of accent and pronunciation. Importantly, convergent validity will be explored following the previous validation studies and, therefore, include measures of ER (i.e., ERQ, FFMQ), difficulties of ER (i.e., DERS), and a measure of psychopathology (i.e., CES-D). These measures were selected because they assess similar constructs (e.g., FFMQ assesses cognitive aspect of ER) or constructs they are expected to correlate with based on the ACE model (e.g., depression) (Berking & Whitley, 2014).

The present study

To address this important gap in the literature, the objective of the present study is to validate a French version of the ERSQ by analysing its psychometric properties using confirmatory factor analyses. Internal consistency, test-retest reliability, measurement invariance, as well as convergent validity were also explored. It was hypothesised that the original structure of the nine-factor questionnaire would be retrieved through confirmatory analysis. It was also posited that the French version of the questionnaire would have an internal consistency comparable to the English version (i.e., from $\alpha = .73$ to $\alpha = .88$ for the subscales; Grant et al., 2018) as well as show good test-retest validity (i.e., a significant correlation between repeated responses to the ERSQ on a three-week interval).

Regarding convergent validity, in an attempt to replicate the results of Grant et al. (2018), it was expected that the subscales of the ERSQ would be positively associated with other measures of ER (e.g., the ERQ) and negatively associated with measures of ER dysfunction (e.g., DERS). Specifically, it was estimated that a positive association would be found between all subscales of the ERSQ and the ERQ-Cognitive Reappraisal and the ERQ-Suppression (reversed items), as found in the original German and English versions. It was also anticipated that a positive association between the Awareness, Acceptance, and Tolerance subscales of the ERSQ and the FFMQ (Five Facet Mindfulness Questionnaire) would be

observed, as well as an inverse correlation between the ERSQ subscales and the ERQ-Suppression, DERS-Awareness, DERS-Clarity, DERS-Non-Acceptance, DERS-Strategies.

Method

Sample size calculation

Sample size calculation for SEM is based on the overall model fit and/or based on the association among the latent variables. These sample size calculations were based on the models proposed by MacCallum and Austin (2000). Using the generator R code, a minimum sample size required to achieve a given level of power for testing a covariance structure model using RMSEA (testing close to fit hypothesis) was computed (Preacher & Coffman, 2006), using the following website: <https://timo.gnambs.at/research/power-for-sem>. Based on previous research (Grant et al., 2018), parameters were set at $\alpha = .05$, $df = 289$, desired power = .80, Alternative RMSEA = .08 (RMSEA > .08 is generally interpreted as poor fit), and Null RMSEA = .07, requiring a sample of 282 participants. In order to take into account potential partial responders, an additional 30% was added to the calculation for a more definitive required sample size of 367 participants.

Participants

To evaluate the psychometric properties of the French version of the ERSQ, a sample of $N = 377$ participants from France and $N = 281$ from Canada was recruited. This resulted in a total sample size of $N = 658$ participants, using the same questionnaires in both samples. In France, participants were recruited with the help of ads on social media platforms (e.g., Facebook, through groups such as 'students of France'), CNRS mailing list (RISC, www.risc.cnrs.fr), and the university intranet. Acquaintances were requested to spread the word to their colleagues, family, and friends. In Canada, participants were also recruited from social

media platforms, mainly from different targeted Facebook groups and LinkedIn. On social media platforms, the study was promoted via multiple groups (i.e., students, sport clubs, etc.).

Participants were included if they were French speakers and at least 18 years old. Conversely, they were excluded if they failed three or more attentional checks dispersed throughout the online survey as a procedure to control for careless responders. In total, eleven participants were excluded because they failed to respond correctly to these attentional checks in France. In Canada, no participants were excluded on the basis of validity questions since they correctly responded to all prompts. It is of note that 13 participants were kept in the sample despite missing one attention check. No stereotyped answers were identified among participants.

Translation

The ERSQ was translated into French following Sousa and Rojjanasrirat's guidelines (Sousa & Rojjanasrirat, 2011) and based on Grant et al.'s English version of the questionnaire (2018). Following the completion of the first draft of the translated measure from English to French executed by two independent bilingual translators (a clinician with expertise in ER and another expert clinical psychologist), a comparison of the two versions was conducted in order to create a preliminary French version of the questionnaire. The feedback of other health professionals on the initial version of the translated measure was also requested. Subsequently, a back translation (French to English) was conducted by two other independent translators who were blind to the original version of the questionnaire. The resulting back-translated English version was then compared to Grant et al.'s English version. If authors identified important differences between the two English versions (original-validated and back-translated), they modified the initially-translated French version. This French version of the ERSQ was piloted on 48 participants (from the French general population), who evaluated the instructions and the

items using a dichotomous scale ('clear' or 'unclear'). The French version of the questionnaire was then adapted with the help of feedback provided by participants (see Supplementary material). For instance, items that were rated as unclear by several participants were slightly reformulated (e.g., item 2, from '*J'ai pu volontairement déclencher des sentiments positifs*' to '*J'ai pu délibérément déclencher des sentiments positifs*').

Measures

Sociodemographic data.

Participants were asked to provide demographic and clinical information, including their gender, age, level of education, status, and medical data (i.e., current psychiatric diagnosis, current psychiatric medication).

Emotion Regulation.

Dimensions of ER were measured using the ERSQ as well as two other well-known and validated scales. The Emotion Regulation Skills Questionnaire - ERSQ (Berking & Znoj, 2008; Grant et al., 2018) is a questionnaire comprised of 27 items that measure ER skills as defined by Berking and Whitley's ACE model (2014) through nine factors: attention, sensations, clarity, understanding, modification, acceptance, tolerance, confrontation with situations, self-support. Each item is assessed using a Likert scale ranging from 0 'Not at all' to 4 'Almost always'. Each subscale is composed of three items. Each skill can be evaluated by computing the average of the corresponding items belonging to each subscale. Internal consistency of the ERSQ subscales ranged from .67 to .96 in the original version (see the descriptive data subsection in the results for the internal consistency in the present sample).

The Emotion Regulation Questionnaire – ERQ (Christophe et al., 2009; Gross & John, 2003) is a scale that includes 10 items allowing the evaluation of emotional regulation strategies and more specifically those of expressive suppression (4 items – inhibition of emotional

response) and cognitive reappraisal (6 items – evaluation of a situation allowing to reduce or increase its emotional expression). Each item is assessed using a seven-point scale ranging from 1 ‘Not at all’ to 7 ‘Completely’. The scale was translated and validated into French by Christophe et al. (2009), reporting internal consistency of the reappraisal and suppression subscales at .76 and .72, respectively (see Results section for psychometric properties in the present sample).

The Difficulties in Emotion Regulation Scale - DERS (Dan-Glauser & Scherer, 2012; Gratz & Roemer, 2004) is a questionnaire which is comprised of 36 items that measure difficulties in emotional regulation across six dimensions: non-acceptance of emotional responses, difficulties in engaging in goal-oriented behaviours, difficulties in impulse control, lack of emotional awareness, limited access to emotional regulation strategies, lack of emotional clarity. Responses are recorded on a scale ranging from 1 ‘Almost never’ to 5 ‘Almost always’. The study was translated and validated into French by Dan-Glauser and Scherer (2013), reporting an internal consistency of the total scale of .92 (see the descriptive data subsection in the results for the internal consistency in the present sample).

Depressive symptoms.

The study also included the assessment of depressive symptomatology, given its common association with difficulties in ER (Aldao et al., 2010). These symptoms were measured using the Center for Epidemiological Studies Depression CES-D (Morin et al., 2011; Radloff, 1977). This questionnaire is comprised of 20 items using a Likert scale for each item that ranges from ‘Never’ to ‘Always’, and is used to evaluate depressive symptomatology in the general adult population. The scale was translated and validated into French by Morin et al. (2011), reporting an internal consistency ranging from .83 to .96 (see Results section for psychometric properties in the present sample).

Mindful awareness.

To evaluate mindful awareness, which has been associated with a greater reliance on more adaptive ER strategies (Modinos et al., 2010; Roemer et al., 2015), we used the Five Facet Mindfulness Questionnaire FFMQ (Baer et al., 2006). This questionnaire includes 39 items using a Likert scale ranging from 1 ‘Never or very rarely true’ to 5 ‘Very often or always true’ and assesses the capacity for mindfulness through five factors: observation, description, action in awareness, non-judgment and nonreactivity to inner experiences. The scale was translated and validated into French by Heeren et al. (2011), reporting an internal consistency ranging from .76 to .89 (see Results section for psychometric properties in the present sample).

Attentional checks.

In order to ensure the validity of participants’ answers, seven attentional check items were distributed throughout the entire survey. Items aimed to detect random completion or attention lapses and lies (e.g., ‘please answer 4 to this question’, ‘please, do not answer to this question’). The exclusion criteria were applied if three or more of these questions were not correct.

Procedure

Participants completed a web-based survey stored in *Limesurvey* at two different time points. At the first time point, they completed the questionnaires in the following order: informed consent, sociodemographic data, ERQ, DERS, CES-D, FFMQ and ERSQ. After completing the questions, participants were redirected to another study to provide their email addresses in an effort to keep questionnaire endorsements separate from their identifiable data to maintain confidentiality. In doing so, two reminder emails were sent (+ 3 weeks less two days; + 3 weeks) to existing participants three weeks after completing the questionnaires to invite them to complete the second part of the study. At the second time point (three weeks

later), participants were asked to fill out the informed consent, sociodemographic data, and ERSQ. The second part of the completion at 3-week was only performed on the French sample. The study was conducted according to the guidelines of the declaration of Helsinki. Moreover, this research was approved by the CER Grenoble Alpes under the number CERGA-Avis-2021-2, as well as by the McGill University's Research Ethics Board (Reference; File #: 21-03-032). This study was preregistered and material is available on OSF: <https://osf.io/hpy3v/>

Statistical analyses

All variables were tested for normality prior to conducting analyses using a Shapiro-Wilk test. Only the ERSQ and the ERQ questionnaires were normally distributed ($p > .05$). All analyses were performed in R and Rstudio free software version 2021.09 (Rstudio Team, 2020). Confirmatory factor analysis (CFA) was performed using *Lavaan* package (Rosseel, 2012) to test the nine-factor structure of the ERSQ using the maximum likelihood estimator. Also, the nine-factor model was compared to a one-factor model as well as to a hierarchical structure with a higher-order factor that would correspond to an overall ability in ER that could unify nine specific skills. Model fit was ascertained using the chi-square statistic and goodness of fit indicators. The Comparative Fit Index (CFI) and the Tucker and Lewis Index (TLI) values are indicative of a good fit when ranging from .90 to .95 and a very good fit when values are above .95 (Hu & Bentler, 1999). The Root Mean Square Error of Approximation (RMSEA) and its 90% confidence interval (CI) are indicative of acceptable when values are .08 and .06, respectively (Hu & Bentler, 1999). The Standardised Root Mean Square Residual (SRMR; Browne, 1993) is defined as the standardised difference between the observed and the predicted correlation and points to a good fit when values are below .08 (Hu & Bentler, 1999). Model comparisons were performed using the χ^2 -difference test. Subsequently, measurement invariance between French and Canadian samples was also performed using the *lavaan*

package. A Delta CFI $\leq .01$ is considered adequate for metric and scalar invariance (see Cheung & Rensvold, 2002).

The validity and reliability of the French version of the ERSQ were investigated through multiple analyses. First, internal consistency was analysed through McDonald's omegas (ω) by computing a total omega over items from each respective subscale (Dunn et al., 2014; Flora, 2020; McDonald, 1981). This alternative allows to control underestimation bias of Cronbach's alphas when the assumption of tau-equivalence is violated, and as such is considered more adequate (Dunn et al., 2014). Subsequently, Pearson correlations were used to evaluate the test-retest reliability for the two ERSQ scores (two assessment points over a 3-week interval), using the *cor* function from the *stats* package (Scott, 1990). Convergent validity was also analysed through Pearson correlations by comparing scores for the ERSQ and ERQ, DERS and FFMQ scores. Benjamini Hochberg's correction was applied (Hochberg & Benjamini, 1990). To test the comparison between ERSQ scores across the French and Canadian samples, the nine dimensions were compared between the two samples using t-tests. T-tests were also performed to compare groups depending on their self-reported diagnostic status (i.e., non-diagnosed vs depressive or anxious disorders-diagnosed).

Results

Descriptive data

Most French participants did not report any psychiatric diagnosis (82.2%) nor psychiatric medication intake (82%). At a three-week interval, 158 participants had responded to the full questionnaire for the test-retest analysis, aged from 18 to 76 (with a mean age of 35) and 82% of women, with no different indicators regarding sociodemographic data of the entire sample. Further details on descriptive data are available in Table 1. We performed t-tests to compare the French and Canadian samples across the demographic variables (e.g., age) and the ERSQ

scores. The results indicated that the French and Canadian samples did not significantly differ (e.g., age, $p = .464$) (ERSQ dimensions, $p > .03$, after Benjamini Hochberg's correction), highlighting good representativeness across samples. Convergent analysis and CFA of the total sample (French and Canadian) are presented. All analyses performed with the French and Canadian samples can be found separately in Supplementary material. In the present sample, internal consistency for the overall sample was of $\alpha = .78$ for each subscale of the ERQ, .93 for the DERS global score, .94 for the CES-D, and of .89 for the FFMQ (see Supplementary material and *Internal consistency* section below for the ERSQ internal consistency).

Table 1*Descriptive Data*

Variable	French sample (n = 377)	Canadian sample (n = 281)	Total sample (n = 658)
Age (years ± SD)	37.52 ± 14.79	36.71 ± 12.73	37.17 ± 13.95
Highest level of education (n [%])			
Elementary School	2 [0.5]	16 [5.6]	18 [2.7]
College	7 [1.9]	46 [16.4]	53 [8.1]
High School	91 [24.1]	125 [44.5]	216 [32.8]
Licence	138 [36.6]	0 [0]	138 [21.0]
Masters	126 [33.4]	71 [25.3]	197 [29.9]
PhD	13 [3.4]	23 [8.2]	36 [5.5]
Gender (n [%])			
Female	305 [80.9]	263 [93.6]	568 [86.3]
Male	72 [19.1]	18 [6.4]	90 [13.7]
Questionnaires M ± SD			
ERQ – Reappraisal	25.83 ± 6.54	26.34 ± 5.04	26.05 ± 5.94
ERQ – Suppression	13.51 ± 5.69	12.14 ± 4.78	12.93 ± 5.35
FFMQ	138.71 ± 15.49	116.90 ± 11.76	134.14 ± 17.86
DERS	91.24 ± 23.63	81.60 ± 19.73	87.13 ± 22.55
CES-D	18.20 ± 14.86	15.00 ± 12.46	16.83 ± 13.97
ERSQ – Understanding	8.16 ± 2.70	8.53 ± 2.36	8.32 ± 2.57
ERSQ – Awareness	7.68 ± 2.57	8.07 ± 2.18	7.85 ± 2.41
ERSQ – Clarity	8.03 ± 2.70	8.44 ± 2.31	8.21 ± 2.55
ERSQ - Sensations	7.49 ± 2.94	7.06 ± 2.70	7.31 ± 2.85
ERSQ – Tolerance	7.12 ± 2.95	8.00 ± 2.59	7.49 ± 2.83
ERSQ – Acceptance	6.98 ± 2.52	7.64 ± 2.37	7.26 ± 2.48
ERSQ – Self-support	7.58 ± 2.66	8.05 ± 2.33	7.78 ± 2.53
ERSQ – Modification	6.34 ± 2.68	7.01 ± 2.44	6.63 ± 2.60
ERSQ - Confrontation	8.20 ± 2.46	8.34 ± 2.33	8.26 ± 2.41

Note. M: mean; SD: Standard Deviation; ERQ: Emotion Regulation Questionnaire; FFMQ: Five Facets Mindfulness Questionnaire; DERS: Difficulties with Emotion Regulation Scale; CES-D: Center for Epidemiologic Studies-Depression; ERSQ: Emotion Regulation Skills Questionnaire.

Confirmatory analysis for the total combined sample

The one-factor model showed a poor model fit (CFI = .80; RMSEA = .14; $\chi^2=22366.567$, $df = 351$, $p < .001$). The hierarchical structure also showed a poor model fit (CFI = .84; RMSEA = .08; $\chi^2=1894.996$, $df = 315$, $p < .001$) (See Supplementary material). The CFA supported the nine-factor model (Table 2) with an adequate fit for the data, with all approximate fit indices showing acceptable model fit (CFI =.95; TLI = .94; RMSEA =.06, 90% CI [.06-.07]; SRMR =.05; $\chi^2=1668.06$, $df = 576$, $p < .001$); following the recommendations of Hu and Bentler for the interpretation (Hu & Bentler, 1999). All standardised regression estimates were moderate to high and all values were significant at $p < .0001$. Moreover, chi-square difference tests demonstrated that the nine-factor model showed a significantly better fit than the one-factor model ($\Delta\chi^2 = 1819.3$, $df = 36$, $p < .001$). Multi-group CFA were used to test the measurement invariance between the French and Canadian samples, comparing three models. Model 1 imposed no equivalence restriction (configural model), Model 2 assumed that factor loadings were the same across samples (weak invariance model), and Model 3 assumed that both factor loadings and intercept of the latent factor were the same (strong invariance model). As illustrated in Supplementary material, fit indices from the measurement invariance tests across French and Canadian samples were acceptable. Results from the ΔCFI (all $\leq .01$) supported the weak (loadings) and strong (intercepts) invariance of the nine-factor model of the ERSQ across French and Canadian samples (Kline, 2015; Van de Schoot et al., 2012).

The nine-factor structure was also explored on the French and Canadian samples separately (respectively, CFI = .90; RMSEA = .07, TLI = .88; CFI = .91; RMSEA = .06, TLI = .89) (See Supplementary material).

Table 2*Factor loadings, uniqueness, and latent factor covariance for CFA*

Item	Factor	Loadings	Uniqueness	Latent factor covariance		
				Estimate ($p < .001$)		
3	UNDER	.72	.482	UNDER	AWARE	.51
11	UNDER	.82	.328		CLARI	.67
20	UNDER	.82	.328		SENSA	.39
1	AWARE	.58	.664		TOLER	.46
12	AWARE	.72	.482		ACCEP	.46
19	AWARE	.79	.376		SELF-S	.44
6	CLARI	.79	.376		MODIF	.46
13	CLARI	.77	.407		CONFR	.40
25	CLARI	.75	.438	AWARE	CLARI	.48
7	SENSA	.87	.243		SENSA	.31
14	SENSA	.83	.311		TOLER	.36
24	SENSA	.80	.360		ACCEP	.37
4	TOLER	.83	.311		SELF-S	.38
18	TOLER	.87	.243		MODIF	.40
26	TOLER	.90	.190		CONFR	.33
5	ACCEP	.86	.260	CLARI	SENSA	.37
17	ACCEP	.66	.564		TOLER	.42
23	ACCEP	.54	.708		ACCEP	.42
9	SELF-S	.69	.524		SELF-S	.40
15	SELF-S	.71	.496		MODIF	.38
27	SELF-S	.82	.328		CONFR	.36
2	MODIF	.70	.510	SENSA	TOLER	.19
10	MODIF	.81	.344		ACCEP	.23
21	MODIF	.75	.438		SELF-S	.31
8	CONFR	.80	.360		MODIF	.28
16	CONFR	.68	.538		CONFR	.24
22	CONFR	.59	.652	TOLER	ACCEP	.63
					SELF-S	.45
					MODIF	.53
					CONFR	.49
				ACCEP	SELF-S	.38
					MODIF	.44
					CONFR	.43
				SELF-S	MODIF	.60
					CONFR	.48
				MODIF	CONFR	.46

Note. UNDER: Understanding, AWARE: Awareness, CLARI: Clarity, SENSA: Sensations, TOLER: Tolerance,

ACCEP: Acceptance, SELF-S: Self-support, MODIF: Modification.

Internal consistency

As illustrated in Table 3, all omega indices ranged from .70 to .85. As expected, the subscales of the ERSQ showed significant associations, with small to strong intercorrelations ($r = .22 - .80$). Moreover, the test-retest reliability for all scales over a period of three weeks was adequate for all subscales. Also, based on a 95% confidence interval for the ICC estimates, coefficients ranged between .46 to .77. A sample size of 31 participants would have been sufficient to achieve a power of .95, using Grant et al. (2018)'s effect size regarding test-retest correlation (.59) (Gpower). Given the similarity between French and Canadian results, the test-retest analysis was only performed on the French subsample. A total of 158 participants were included in the present test-retest analysis.

Table 3*Total Sample - ERSQ Descriptive Data*

Scale	M ± SD (n = 658)	α	ω	Test-retest (n = 158)	ICC	p	1	2	3	4	5	6	7	8
1. Awareness	7.85 ± 2.14	.75	.76	.57**	.59	.038	-	-	-	-	-	-	-	-
2. Sensations	7.31 ± 2.85	.79	.79	.58**	.54	.054	.52**	-	-	-	-	-	-	-
3. Clarity	8.21 ± 2.55	.82	.83	.64**	.65	.038	.74**	.49**	-	-	-	-	-	-
4. Understanding	8.32 ± 2.57	.84	.84	.76**	.68	.064	.73**	.47**	.80**	-	-	-	-	-
5. Acceptance	7.26 ± 2.48	.70	.70	.53**	.61	.001	.58**	.32**	.54**	.55**	-	-	-	-
6. Tolerance	7.49 ± 2.83	.85	.85	.58**	.63	<.001	.49**	.22**	.47**	.51**	.77**	-	-	-
7. Confrontation	8.26 ± 2.41	.73	.74	.59**	.61	.44	.44**	.28**	.38**	.40**	.50**	.52**	-	-
8. Self-support	7.78 ± 2.53	.78	.78	.43**	.46	.015	.55**	.41**	.45**	.48**	.45**	.49**	.50**	-
9. Modification	6.63 ± 2.60	.76	.76	.63**	.68	.001	.58**	.36**	.43**	.50**	.51**	.56**	.47**	.66**

Note. ω : omega; α : Cronbach's alpha; M: mean; SD: Standard Deviation; *: $p < .001$ (after B.Hochberg's correction); **: $p < .0001$. p : p -value from the t-test comparison

between ERSQ scores across the French and Canadian samples; ICC: Intra-class correlations for test-retest analysis.

Convergent validity

Our correlations analyses supported the hypothesised convergent validity between the different measures included. Firstly, the ERSQ subscales and the DERS subscales were both significantly and negatively correlated. The ERSQ-Awareness and the DERS-Awareness were negatively associated, as well as the ERSQ-Clarity and the DERS-Clarity, the ERSQ-Acceptance and the DERS-Non-acceptance, and the ERSQ total scale and the DERS-Strategies. Moreover, all ERSQ subscales were negatively associated with ERQ-Suppression and positively correlated with the ERQ-Reappraisal. As expected, the ERSQ subscales were also positively correlated with all subscales of the FFMQ. Lastly, the ERSQ was significantly and negatively correlated with the CES-D (see Table 4 for further details and Supplementary Material for analyses of the French and Canadian sample separately).

Table 4

Total Sample - Correlations between ERSQ Subscales and ERQ, DERS, FFMQ

Scales	ERQ-R	ERQ-S	DERS-A	DERS -C	DERS-NA	DERS-S	CES-D	FFMQ	FFMQ	FFMQ	FFMQ
								Total	Awar	Accep	Toler
AWARE	.24**	-.30**	-.61**	-.52**	-.30**	-.39**	-.38**	.56**	.20**	.23**	.40**
SENSA	.16**	-.21**	-.42**	-.29**	-.13**	-.20**	-.12**	.49**	.20*	.22**	.24**
CLARI	.11**	-.39**	-.56**	-.60**	-.33**	-.35**	-.38**	.55**	.21**	.22**	.32**
UNDER	.16**	-.29**	-.56**	-.58**	-.30**	-.37**	-.38**	.54**	.22**	.22**	.39**
ACCEP	.21**	-.15**	-.38**	-.41**	-.44**	-.44**	-.41**	.40**	.07*	.24**	.53**
TOLER	.26**	-.09*	-.46**	-.42**	-.46**	-.54**	-.46**	.39**	.07	.20*	.60**
CONFR	.21**	-.15**	-.39**	-.36**	-.30**	-.36**	-.43**	.37**	.10**	.22**	.32**
SELF-S	.40**	.19**	-.39**	-.35**	-.27**	-.42**	-.39**	.41**	.11**	.14**	.41**
MODIF	.43**	-.19**	-.38**	-.40**	-.35**	-.51**	-.48**	.43**	.09*	.16**	.48**

Note. *: after B.Hochberg's correction, $p < .049$; **: $p < .01$; ERQ-R: Emotion Regulation Questionnaire – Reappraisal; ERQ-S: Emotion Regulation Questionnaire –

Suppression; DERS-A: Difficulties in Emotion Regulation Scale – Awareness; DERS-C: Difficulties in Emotion Regulation Scale – Clarity; DERS-NA: Difficulties in

Emotion Regulation Scale – Non Acceptance; DERS – S: Difficulties in Emotion Regulation – Strategies; FFMQ: Five Facets Mindfulness Questionnaire; FFMQ Awar:

awareness; FFMQ Accep: acceptance(non-judgmental subscale); FFMQ Toler: tolerance (non-reactivity subscale); CES-D: Centre for Epidemiologic Studies Depression

Scale; AWARE: Awareness; SENSA: Sensations; CLARI: Clarity; UNDER: Understanding; ACCEP: Acceptance; TOLER: Tolerance; CONFR: Confrontation; SELF-S:

Self-support; MODIF: Modification.

Comparisons between self-reported diagnostic vs non-diagnostic group

Our results indicate that the groups differ significantly in all scores except for the ERQ-Suppression subscales, the ERSQ-Awareness, the ERSQ-Clarity, and the ERSQ-Sensations. According to all other subscales of the ERSQ, as expected, the self-reported diagnosed-group reported less frequent use of ER strategies and skills (Table 5).

Table 5

Comparisons between Diagnostic vs Non-Diagnostic Groups

Questionnaires	M ± SD Non-diagnosed group (n = 594)	M ± SD Diagnosed group (n = 64)	p
ERQ – Cognitive reappraisal	26.23 ± 5.88	24.31 ± 6.33	.01*
ERQ – Suppression	12.95 ± 5.28	12.67 ± 5.94	.69
FFMQ – total scale	134.66 ± 17.61	129.33 ± 19.53	.02*
DERS – total scale	85.42 ± 21.93	103.00 ± 22.14	< .001*
CES-D – total scale	15.68 ± 13.23	27.56 ± 16.07	< .001*
ERSQ – Understanding	8.39 ± 2.56	7.64 ± 2.54	.02*
ERSQ – Awareness	7.91 ± 2.39	7.30 ± 2.55	.05
ERSQ – Clarity	8.23 ± 2.52	7.94 ± 2.74	.38
ERSQ – Sensations	7.27 ± 2.85	7.66 ± 2.81	.30
ERSQ – Tolerance	7.71 ± 2.77	5.52 ± 2.64	< .001*
ERSQ – Acceptance	7.40 ± 2.46	5.95 ± 2.20	< .001*
ERSQ – Modification	6.77 ± 2.59	5.33 ± 2.37	< .001*
ERSQ – Self-support	7.87 ± 2.54	6.97 ± 2.39	.01*
ERSQ – Confrontation	8.39 ± 2.34	7.03 ± 2.70	< .001*

Note. M = mean; SD = standard deviation; *= after Benjamini-Hochberg's correction, $p < .037$; ERQ = Emotion Regulation Questionnaire; FFMQ: Five Facets Mindfulness Questionnaire; DERS: Difficulties in Emotion Regulation Scale; CES-D: Center for Epidemiologic Studies – Depression; ERSQ = Emotion Regulation Skills Questionnaire.

Discussion

The goal of the current study was to validate a French version of the ERSQ by assessing its psychometric properties in a French and Canadian general population. Our study revealed that the French version of the ERSQ demonstrates adequate psychometric properties and, thus, can be used in French and Canadian samples as a reliable instrument to assess ER skills. Indeed, the confirmatory factor analysis supports a nine-factor solution found in previous studies (Berking & Whitley, 2014; Grant et al., 2018). Conversely, the hierarchical solution showed poor fit. This emphasises that no common factor seems to underlie the nine skills, which implies that using the global score of the ERSQ is unwarranted to measure ER skills as a single factor. Specifically, it emphasises that the questionnaire adequately measures nine competencies that are independent, even though they may be related, as illustrated by the latent factor covariances ranging from .19 to .67. For example, the ACE model specifies that the first skills (e.g., awareness, clarity) are required to apply later skills (e.g., acceptance, modification) (Berking & Whitley, 2014). This is in agreement with recent studies showing no common underlying factor in ER strategies (see Naragon-Gainey et al., 2017). These results align with the ACE model (Berking et al., 2010), which is based on the assumption that adaptive ER ability refers to interactions between ER skills in a contextual-adapted manner. Indeed, an efficient ER would require the ability to apply several skills according to contextual demands (Aldao et al., 2015).

Extending those findings, our results provided support for the weak and strong invariance of the ERSQ across French and Canadian samples. Despite the differing cultural contexts, the ERSQ seems to perform similarly across the two countries, suggesting that it measures the same constructs and that the items are performing equally. It is of note that the Tucker Lewis Index (TLI) was not satisfactory in the analyses on the separate subsamples (<.90). Indeed, the TLI is known to decrease with smaller sample size, even when the model is adequate (Shi et al., 2019). Our analyses provide further evidence in this direction. The model

was found to be satisfactory for both our total ($N = 658$) and French sample ($N = 377$). Conversely, our Canadian sample was composed of 281 participants, which might have affected the TLI. Moreover, our results replicate those of Grant et al. regarding the internal reliability of the total scale and the subscales. More specifically, our results showed that the total scale has a high internal consistency ($\omega = .94$), and the subscales' omegas ranged between .70 to .85.

The ERSQ was assessed twice with a three-week interval to ensure stability over time of the ER constructs measures. Results showed good test-retest validity for the total scale ($r = .84$) and acceptable reliability for the subscales. This gap may highlight the fact that the overall ability to regulate one's emotion (measured by the total scale) is quite stable over time. In contrast, each competency might undergo fluctuations according to different contexts. Importantly, these results concur with those found in its English validation, supporting this hypothesis. Furthermore, the convergent validity was supported by associations between the ERSQ and other scales measuring ER (e.g., ERQ, DERS). Also, our results regarding the ERSQ and the CES-D are congruent with the literature, which has successively found correlations between depressive symptoms and ER difficulties (see Sloan et al., 2017 for a review).

Furthermore, our comparative analysis between non-diagnosed and diagnosed-group reinforces previous findings on associations between mental health difficulties (such as depressive and anxious disorders) and ER difficulties (Aldao et al., 2010). Indeed, in our sample, individuals who self-reported a diagnosis of mental disorder reported greater reliance on maladaptive strategies and less use of adaptive strategies compared to the non-diagnosed group. Nonetheless, these results must be interpreted with caution given the fact that the group assignment was based on a single self-report item *'I am currently suffering from a psychiatric condition diagnosed by a psychiatrist or psychologist'*.

The ERSQ is particularly relevant when assessing ER because, contrary to other questionnaires (e.g., the ERQ or the DERS), it allows for a measure of multiple skills and

dimensions, which are supposed to be central for an effective ER. In addition, its nine-factor structure permits better discrimination between the different skills being evaluated. Given the number of studies that demonstrated positive associations between these skills and mental health (Berking et al., 2013), the competencies as described in the ACE model can be considered promising targets to improve both the understanding of ER as well as the interventions targeting ER. Indeed, a better understanding of the crucial aspects of an efficient ER may give rise to more precise psychological interventions. More specifically, the skills associated with tolerance, acceptance, and modification of emotions appeared as the key components of ER, which in turn, were associated with reduced depressive symptoms (Berking et al., 2012). Therefore, future interventions targeting ER should focus on improving these main skills. However, we believe ER is a very broad construct that relies on various affective substrates, and as such, it warrants that future studies explore other unidentified or underexplored domains of this construct to potentially highlight the limitations of existing validated measures.

Limitations

The results of this study must be interpreted within the context of its limitations. Firstly, we only assessed the convergent validity through self-report measures. Future studies should include a less biased design, for example, using some behavioural tasks. Nevertheless, little is known about the correlations between those two measures considering that self-report measures often assess the frequency. In contrast, behavioural tasks measure the ability to implement an ER strategy or skill. Secondly, our sample was mainly comprised of women (86.3%), and given known gender differences which have been highlighted in the literature, thus potentially affecting the representativeness of the reported findings (Goubet & Chrysikou, 2019; Nolen-Hoeksema et al., 2008). Thirdly, this version of the ERSQ assesses to individual's ability to

manage emotions more generally, with no specification on the type of emotional states the individual experiences. A modified version of this questionnaire was developed by Berking et al. (2013), the ARSQ (Affect Regulation Skills Questionnaire), and assesses these skills separately in the context of various affective states (i.e., stress/tension, anxiety, sadness, anger and depressive mood) including positive emotions. This measure has the advantage of providing new information on how ER skills vary according to the emotional states. Moreover, future studies should also investigate the reliability and replicability of our French validation. Lastly, the differences between diagnosed vs non-diagnosed groups were based on self-reported information on existing psychiatric diagnostics; and, as such, may have been underreported. Therefore, these results must be interpreted with some caution, and future studies should assess the ERSQ in clinical samples.

Strengths

The results from this study are based on a large number of participants. Moreover, the reliability of the French version of the ERSQ was validated in both French and Canadian cultures. Test-retest and multiple convergent variables were tested, a better measure of internal consistency was used and the study was preregistered.

Conclusion

The study demonstrated satisfactory psychometric properties of the French validation and showed that the French version of the ERSQ remains stable in both French and Canadian populations. The questionnaire can be considered a reliable instrument in measuring nine ER skills. This study finally revealed that no global score can be calculated for this scale. Future studies should rather calculate nine scores corresponding to the nine skills measured by the ERSQ.

CHAPTER 1 - CONCLUSION

This first chapter has enabled us to lay the foundations of ER research. Going beyond the dual categorisation of ER strategies (i.e., adaptive vs maladaptive), recent conceptualisations of ER processes highlight more general ER skills (e.g., identification of emotions, acceptance) essential to an adaptive ER. These skills are also promising to improve ER *flexibility*, which has been identified as a fundamental ‘meta’ competency towards an efficient ER. Therefore, the next section will address current issues related to ER flexibility, from theoretical frameworks to methodological and measurement aspects, and will include both a French validation of the Context Sensitivity Index and Flexible Regulation of Emotional Expression scale (Study 2), a systematic review (Study 3), and an experimental research (Study 4).

CHAPTER 2. WHAT IS EMOTION REGULATION FLEXIBILITY AND HOW CAN IT BE MEASURED?

In this second chapter, we will focus on ER flexibility and investigate its methodological and measurement aspects. In the first part, we will describe the theoretical basics and models of ER flexibility. Next, we will present questionnaires that have been developed to measure flexibility before addressing current issues related to its assessment. This chapter will present a French validation of two questionnaires on flexibility (Study 2), a Systematic Review (Study 3), and an experimental study (Study 4).

Even though the first investigations on ER have mainly focused on ‘adaptive’ as opposed to ‘maladaptive’ strategies, research in the field has largely evolved to more dynamic perspectives, specifically through person-situation interactionist models. Theoretical pathways towards recent conceptualisations of ER processes (i.e., ER flexibility) are presented in the next section.

1. From emotion regulation to emotion regulation flexibility

Let’s imagine that when Billy is upset, he is used to expressing his emotions to those around him. When he is with his family this is indeed effective because they offer him reassurance. However, in professional contexts, this is not very helpful and even considered not adaptive. Consequently, Billy manages to develop other strategies to regulate his emotion and to accurately choose ER strategies depending on the situation and his goals. The so-called adaptive strategy of emotional expression in this story is actually only adaptive in specific situations. It is to account for this sort of observation that new theories about the adaptability

of flexibly employing strategies have emerged, rather than considering putatively adaptive or maladaptive strategies.

1.1. Is there anything that is always good or always bad?

As described in Chapter 1, ER has often been classified as ‘adaptive’ or ‘maladaptive’ strategies depending on their relation with psychological symptoms and mental health (Aldao et al., 2010). It is assumed that adaptive ER strategies would be efficacious in reducing negative affect and increasing mental health, contrary to maladaptive strategies (Aldao et al., 2010). Recent findings indicate that this binomial categorisation has some limitations, showing that strategies’ adaptability (e.g., reappraisal) depends on the situation or, more precisely, on the situation’s characteristics (e.g., controllability, Troy et al., 2013). Indeed, our environment being in constant change, a flexible adaptation (response) to these changes (i.e., flexibility) seems to be associated with better mental health outcomes (Aldao & Dixon-Gordon, 2014; Kashdan & Rottenberg, 2010; Kobylńska & Kusev, 2019). On the contrary, constantly using the same strategy (i.e., displaying ER inflexibility/rigidity) has been found to be associated with poorer outcomes (Morris & Mansell, 2018; Stange et al., 2017). Consistently, psychological disorders are commonly characterised by rigid responses to their environment (Aldao, 2013; Morris & Mansell, 2018), which leaves room for the potential benefits of flexibility.

An increasing number of studies have demonstrated that the effectiveness³ of specific strategies depends on the situation (Bonanno et al., 2004; Carver & Connor-Smith, 2010; Folkman & Moskowitz, 2004; Troy et al., 2013). In other words, a strategy that is effective in

³ Even though most articles use these words interchangeably, we believe it is of valuable information to delineate between the three terms. *Efficacy* refers to the capacity to apply a given strategy in controlled designs (is it working?); *effectiveness* refers to the ability to reach outcomes in more ecological designs (is it actually working well?); *efficiency* refers to the resource utilisation and cost-effectiveness of a strategy (is it working within the most economical way?) (Burches & Burches, 2020; Patel, 2021).

a given situation might not be efficient anymore when facing another situation (e.g., Folkman & Moskowitz, 2004). To illustrate, a study has shown that reappraisal has different effects according to the goals pursued (McRae et al., 2012) and may not be the most appropriate strategy when facing controllable contexts (Haines et al., 2016; Troy et al., 2013).

Bonanno and Burton named this initial dual perspective the *fallacy of uniform efficacy* (2013) due to the variability in the effectiveness of the so-called adaptive strategies on mental health and emotional outcomes. Webb et al.'s meta-analysis showed small to medium differences between types of strategies (e.g., cognitive change, attentional deployment, response modulation) on their efficacy and, more importantly, depending on the strategy's subtype (e.g., reappraising the emotional stimulus vs reappraising the emotional response) (2012). However, the studies included in their analyses were instructions-based, thus only providing information on ER efficacy when participants are instructed to choose a strategy in a controlled laboratory design. More ecological studies' findings suggest that an efficient ER would depend on a *situation-fit ER strategy choice* (e.g., English et al., 2017; Millgram et al., 2019; Newman & Nezlek, 2019). In agreement, a broad number of studies have shown that individuals differ in their ER strategy-choice according to the context (e.g., Cheng, 2001; Sheppes & Gross, 2012; Sheppes et al., 2011) and even employ several strategies simultaneously (Brans et al., 2013; Kalokerinos et al., 2017). These findings emphasise complex sequences in ER dynamics (Ford et al., 2019) as opposed to the reductionist approach of putatively adaptive or maladaptive strategies.

1.2. A myriad of definitions surrounding flexibility

When studying flexibility, one is confronted with a plurality of definitions since the concept has been studied under the scope of miscellaneous areas. All definitions of flexibility

seem to have in common the hypothesis of a *strategy-environment-fit*, which was already mentioned in the coping theory (Folkman & Moskowitz, 2004) and even emphasised in the definition of coping: ‘thoughts or behaviours that people use to manage the internal or external demands of situations that are appraised as stressful’ (Folkman & Moskowitz, 2004, p.746).

To start with, some authors use the term *coping flexibility*, which is defined as ‘the variability in the deployment of diverse coping strategies [...], capacity to exhibit such variability in a way that fosters adjustment to life changes’ (e.g., Cheng et al., 2014, p.1). Elsewhere coping flexibility is defined as the ability to stop an ineffective coping strategy and produce and implement an alternative one (e.g., Kashdan & Rottenberg, 2010; Kato, 2012). Other authors use the term *cognitive flexibility*, defined as the ability to think flexibly and change perspectives and approaches easily (e.g., Arici-Ozcan et al., 2019). In turn, *regulatory flexibility* has been defined as the interplay of both appraising contextual demands, generating, choosing, and applying ER strategies, as well as the ability to be sensitive to feedback regarding the outcome of one’s strategies and change strategy if needed (e.g., Bonanno & Burton, 2013). Others refer to the concept of *psychological flexibility*, which is considered as a ‘meta’ process composed of other processes (e.g., acceptance, attention to the present moment, values) and understood as a global ability to change (Hayes et al., 1999). In the Acceptance and Commitment Therapy framework, psychological flexibility is specifically defined as ‘contacting the present moment as a conscious human being, and, based on what the situation affords, acting in concordance with one’s chosen values’ (Bond et al., 2006, p.28). Finally, *ER flexibility* - currently defined as variations in ER responses in synchrony with the context (Aldao et al., 2015) - will be specifically described in this chapter. Table 1 summarises flexibility’s definitions.

Table 1*Flexibility's definitions*

Concept	Definition	Author
Coping flexibility	'Variability in the deployment of diverse coping strategies [...] capacity to exhibit such variability in a way that fosters adjustment to life changes'	Cheng et al., 2014
	'Ability to stop an ineffective coping strategy and produce and implement an alternative one'	Kashdan & Rottenberg, 2010
Cognitive flexibility	'Ability to think flexibly and change perspectives and approaches easily'	Arici-Ozcan et al., 2019
Regulatory flexibility	'Interplay of both appraising contextual demands, generating, choosing and applying ER strategies, as well as the ability to be sensitive to feedback regarding the outcome of one's strategies and change strategy if needed'	Bonanno & Burton, 2013
Psychological flexibility	'Contacting the present moment as a conscious human being, and, based on what the situation affords, acting in concordance with one's chosen values'	Hayes et al., 1999
Emotion regulation flexibility	'Variations in ER responses in synchrony with the context'	Aldao et al., 2015

1.3. Current perspectives and models of emotion regulation flexibility

Since an increased interest has emerged on flexibility, numerous theoretical propositions have been formulated. We acknowledge that the following section is not exhaustive but rather a depiction of the main influential models that have theoretically driven the studies included in this dissertation.

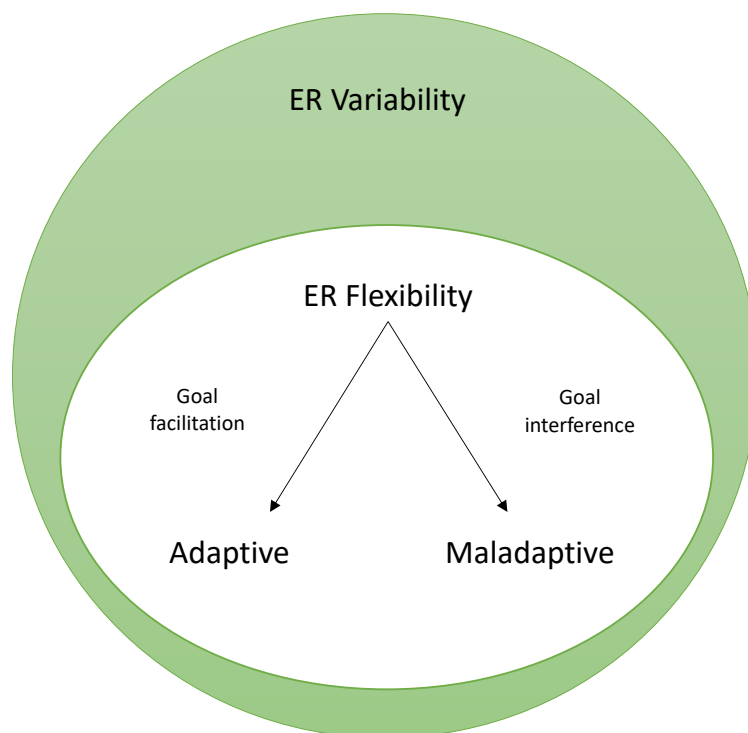
ER flexibility: variability, flexibility, adaptability (Aldao et al., 2015)

One of the most influential works on flexibility was conducted by Aldao et al. (2015). They described three components of ER flexibility: ER variability, flexibility, and adaptability. ER *variability* is the variability with which one uses a strategy over time (i.e., within-strategy

variability) and the variability with which one uses several strategies (i.e., between-strategy variability). In turn, ER *flexibility* is described as the degree of covariation between ER variability and environmental changes. Lastly, *adaptability* refers to the suitability of ER flexibility with the individual's personal goals (Aldao et al., 2015). In other words, an efficient ER would first require the ability to vary the use of strategies (variability). But this variability could also represent ineffective regulation attempts, and thus, secondly, effective variability should be adapted to situational demands (flexibility). Thirdly, flexibly employing strategies should take place in agreement with current goals (adaptability). For example, an individual using several strategies well suited for specific contexts but that are not in accordance with their goal would not be considered as effective regulation. As such, Aldao et al. argue that an efficient ER requires both ER flexibility and adaptability (see Figure 1).

Figure 1

The adaptability of flexibility (adapted from Aldao et al., 2015)



*Adaptiveness*⁴ has also been considered as ‘associations with better longer-term outcomes’ (Ford et al., 2019). This emphasises that both short- and long-term goals should be considered (Aldao et al., 2015). To illustrate, an individual could apply a strategy (e.g., distraction) that is congruent with his current goal(s) (e.g., decrease the emotional intensity to avoid being angry with their partner) but inconsistent with longer aims (e.g., being genuine with their partner). Findings have supported the necessity of both strategy-situation fit and goal attainment in ER flexibility (e.g., Cheng, 2001), showing that different ER goals (e.g., hedonic, instrumental, social) predicted different ER choices in daily life (Eldesouky & English, 2018; English et al., 2017).

Although variability is required to act flexibly, it is not synonymous with flexibility (Kalokerinos & Koval, 2022). Indeed, variability could be synonymous with random attempts to regulate and would rather represent difficulties in applying strategies effectively (Aldao et al., 2015). For example, Blanke et al. (2020) found high within-strategy variability to be associated with depressive symptoms, thus suggesting the need for an optimal level of variability to regulate successfully. However, they also showed that between-strategy variability was associated with lower negative affect. These apparent incongruent results point towards the importance of considering context to appropriately and carefully select strategies (Blanke et al., 2020).

Regulatory flexibility: context-sensitivity, repertoire, feedback (Bonanno & Burton, 2013)

Bonanno and Burton (2013) theorised three main components of flexibility. More precisely, their model describes an initial and crucial phase of *context-sensitivity*, which is the ability to detect the absence/presence of cues in the environment (Chen & Bonanno, 2021) and determine what is happening to best respond to the situation. This emphasis on context

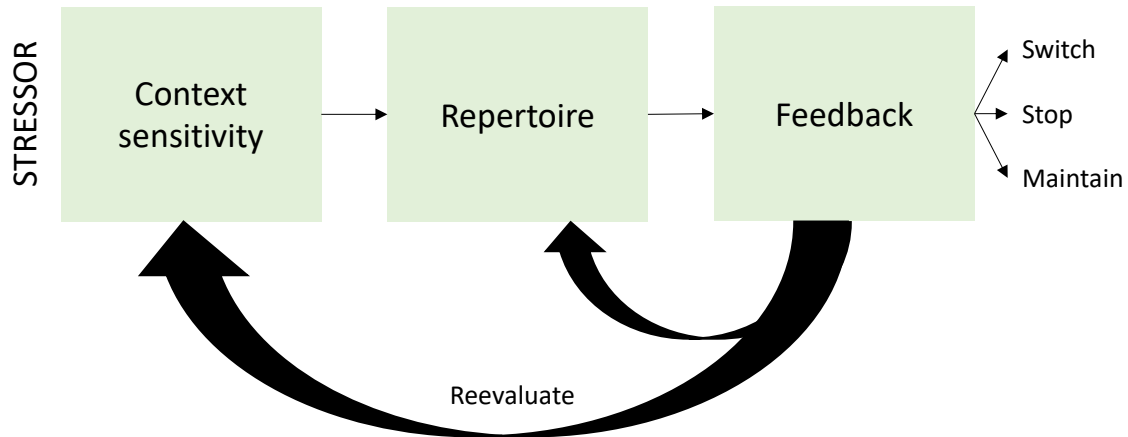
⁴ Adaptiveness is used interchangeably with adaptability: both refer to the state or quality of being adaptive.

complements Aldao et al.'s model by outlining the abilities required to decode contextual changes that influence variability in the use of strategies. This evaluation of the absence or presence of contextual cues echoes the appraisal processes' framework of emotions (Carver & Scheier, 1982; Frijda, 1986; Scherer et al., 2001). For instance, some of the cues described in their model refer to urgency ('how urgently do I need to respond in the situation'), controllability ('how much control do I/others have in the situation'), and threat ('how threatening is this situation') (Bonanno et al., 2020; Lazarus & Folkman, 1984). This context-sensitivity phase is followed by the selection of the most appropriate strategy (*What do I need to do?*) according to the set of strategies available (i.e., *repertoire*) also based on what the person is able to do effectively (*What am I able to do?*). Finally, when the strategy is implemented, the authors describe a process of strategy monitoring that allows maintaining, stopping, or switching strategy (i.e., *feedback*) (Bonanno & Burton, 2013; Chen et al., 2020; Cheng et al., 2014) (see Figure 2).

Each flexibility component has been associated with mental health and well-being in initial studies. For instance, some markers of context, such as controllability of the situation, have been found to moderate the effectiveness of strategies (Bonanno et al., 2020). Troy et al. (2013) found that reappraisal was only adaptive when the stressors were appraised as uncontrollable, a finding replicated in daily studies (e.g., Haines et al., 2016). Also, a wide range of strategies available has been associated with better resilience and less distress (Bonanno et al., 2004; Orcutt et al., 2014). Finally, the ability to switch strategy according to internal feedback has been identified as crucial to well-being (Birk & Bonanno, 2016). One major added value of this line of research is the emphasis placed on measuring the *ability* to apply a strategy correctly instead of only focusing on the *frequency* with which strategies are implemented (Bonanno et al., 2004).

Figure 2

Regulatory flexibility model (adapted from Bonanno & Burton, 2013)



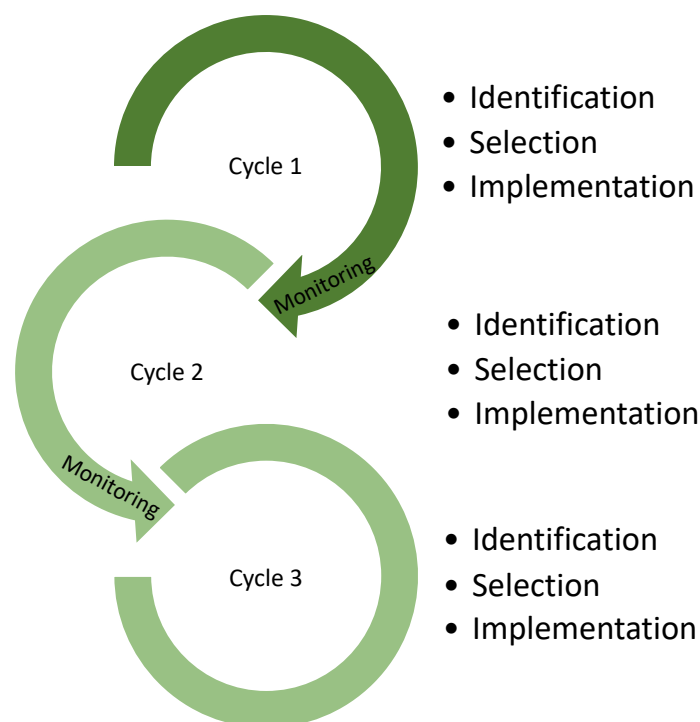
Extended Model of ER process: identification, selection, implementation (Gross, 2015)

Relatively similar sequential stages were conceptualised by other influential authors in the field, with slightly different formulations. More precisely, Gross (2015) revised their initial model (1998, see Chapter 1, p.10 for a description) to consider the ER process as interactions between different evaluative systems. When facing a gap between the current emotion and the desired state or behaviour, ER arises. The author describes three stages in the ER cycle: identification, selection, and implementation. The first stage enables the *perception* of the emotion, choosing whether to regulate if necessary. Next, the activation of ER goals leads to a *strategy choice* that will be used to regulate the emotion. The third stage refers to the *implementation* of the chosen strategy in a situation-adapted way. This implementation is then monitored and leads to either maintenance, stop, or switch of strategy, representing the beginning of a second cycle where the target of the evaluation becomes the initial cycle. This extended model illustrates the dynamic features of ER through almost unlimited cycles of valuation that interact with each other (Gross, 2015) (see Figure 3). It further suggests a decision-making process in each step of the ER process (Sheppes, 2020).

For the authors, the different choices made would rely on different factors, including the intensity of emotional information, the degree of engagement or disengagement related to it, and the associated cognitive cost (Sheppes, 2020). Specifically, Sheppes et al. go beyond the classical categorisation of adaptive vs maladaptive strategies to underline the importance of context (2011).

Figure 3

Gross's process model of emotion regulation (adapted from Gross, 2015)



Towards an intervention-oriented integrative model

It is worth mentioning that all previous conceptualisations have been summarised in an intervention-oriented framework by Southward et al. (2021), which delineates key ER mechanisms and targets for clinical interventions. In addition to reviewing central aspects already identified in the ER field (e.g., the importance of the repertoire and contextual

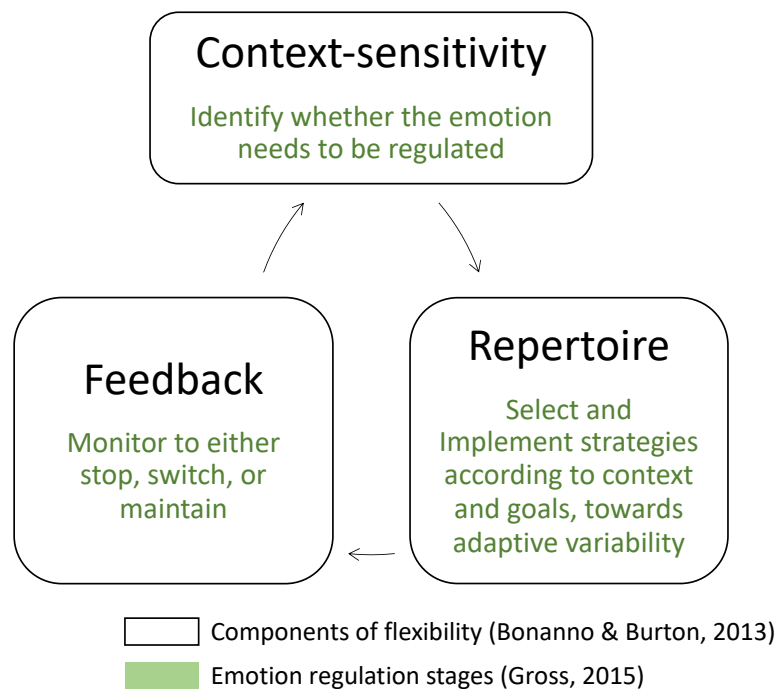
characteristics), they also introduce another aspect, i.e., ER *quality*, which describes how well a person uses a strategy in line with how the strategy was taught or conceptualised. More precisely, they add to the commonly-described *implementation* stage (Gross, 2015) the importance of a qualitative implementation. For example, an individual could apply a given strategy that is adapted to the current context but could have difficulties in applying it effectively. Accordingly, Southward et al. distinguish the concept of *effectiveness* from *adaptiveness*, the first referring to short-term outcomes and the latter to longer-term outcomes, in agreement with Aldao et al.'s definition of adaptability (Aldao et al., 2015).

The above conceptualisations of flexibility converge towards a dynamic process composed of key stages and related abilities necessary to an efficient ER and can be summarised as follows. First, individuals appraise the context where they found themselves in terms of urgency to respond, controllability, level of threat (among others) (*context-sensitivity*; Bonanno & Burton, 2013) and whether, in this context, they need to regulate their emotions (*identification*; Gross, 2015). Next, the individual needs to own a sufficient *repertoire* of ER strategies and, therefore, have the ability to use them (Bonanno & Burton, 2013) to allow for a choice of strategy (*selection*; Gross, 2015). To be truly flexible in these first steps, the individual needs to be able to choose specific strategies (*variability* as opposed to always choosing the same; Aldao et al., 2015) and, more importantly, this strategy *choice* needs to be guided *adaptively* by the contextual features of the situation and their goals (i.e., *flexibility*; Aldao et al., 2015). Then, the individual applies such strategy (i.e., *implementation*, Gross, 2015) *qualitatively* (Southward et al., 2021). This application needs to be *monitored* (Gross, 2015), depending on *feedback* abilities (Bonanno & Burton, 2013), so that they can either stop, change, or maintain their strategy-choice (i.e., *adaptation*), again depending on the context (*context-sensitivity*; Bonanno & Burton, 2013) and the *effectiveness* of the strategy (Southward et al.,

2021). All these steps should promote self-efficacy to strengthen adaptive ER (Southward et al., 2021) (see Figure 4, in which we propose a summarising model).

Figure 4

Summarising model on ER flexibility



Therefore, the earlier determinants of the ER process seem to be associated with the context, which has been analysed through many different factors. Thus, we argue that the first issue related to ER flexibility measurement lies in which contextual aspects are to consider, probably depending on their strength of influence on ER choice.

1.4. In the end, it all depends on the context

Although authors have been trying to define and evaluate context, no consensus has emerged so far. Context has been defined and studied in numerous ways, from emotion intensity being the most studied (e.g., Sheppes & Meiran, 2008; Sheppes et al., 2011) to external features

(location, activity, etc., e.g., Goubet & Chrysiou, 2019), controllability appraisals (e.g., Haines et al., 2016), social context (e.g., English et al., 2017), and personal characteristics (i.e., internal context, '*organism*', Aldao et al., 2013) such as self-esteem (e.g., Wood et al., 2009), psychopathology (e.g., Millgram et al., 2020), or goals (e.g., Millgram et al., 2019)⁵. Others have also considered context more broadly as time-changing variability (Blanke et al., 2020).

Given the plurality of contextual variables that can be considered to have an influence on ER, some authors have simultaneously attempted to define context more accurately. For instance, Aldao et al. define context as 'different situations that vary in critical affective dimensions, such as emotional valence, motivation, and interpersonal contexts (Aldao et al., 2015, p.5). Greenaway et al. (2018) proposed, in turn, that context can be understood at multiple levels, including the person's characteristics (level 1; e.g., demographics, personality, and stimulus appraisal), the situation they found themselves in (level 2; e.g., social relationships, the goals associated with the context, and the type of situation) and, finally, the culture (level 3). As another example, Southward et al. (2021) have differentiated biological factors (e.g., neural structure), psychophysiological factors (e.g., heart rate variability), developmental trajectories (e.g., history of childhood trauma), environmental affordances and situational factors (e.g., controllability of the stressor, goals, interpersonal surroundings, emotional intensity), and finally individual-difference factors (e.g., age, gender, culture). More recently, based on a meta-analysis of 219 studies, Matthews et al. (2021) have attempted to categorise contextual variables that influence whether and how people regulate their emotions. Their results led them to propose five classes of determinants: affective (e.g., valence, intensity), cognitive (e.g., cognitive effort), motivational (e.g., goals, monetary incentives), individual (e.g., age, gender, mental health), and socio-cultural (e.g., need to belong within a group, culture), all having an influence on the intention to regulate and ER choice. All these definitions

⁵ The results associated with these studies are presented in the Systematic Review (Study 3)

have in common the distinction between the person's characteristics from the situational characteristics. As such, it is possible to consider all organism-related factors (Aldao, 2013) as antecedents in the contextual variables string.

In this perspective, another influential but less studied contextual factor has been outlined as impacting ER success: beliefs about emotions, which could also be considered as the person's characteristics (level 1, Greenaway et al., 2018). Ford et al. (2019) reviewed how beliefs (such as whether emotions are good or bad, controllable or not) could impact each of the steps (including strategy choice) described in the process model of ER (Gross, 1998). For example, individuals who believe an emotion is always bad could engage in regulation on any emotional occasion (Ford et al., 2019). Also, individuals who believe an emotion is uncontrollable may lack perseverance in applying ER strategies.

Another promising factor is ER self-efficacy (as another individual's characteristic of context), which could have a major impact on an efficient ER (Denny, 2020; Goldin et al., 2013). In the perspective that self-efficacy beliefs have been commonly associated with ER (Bandura & Locke, 2003), Goldin et al. (2013) found that cognitive reappraisal self-efficacy mediated the effects of cognitive-behavioural therapy on social anxiety symptoms.

Thus, context in ER can be understood as each factor (either internal or external; either proximal such as situational elements, or distal such as personality traits, beliefs on emotions, values) that contributes to influencing ER choice at each step of the decision-making process (see Table 2 for a summary).

Table 2

Potential contextual variability identified (from Aldao, 2013; Matthews et al., 2021)

DISTAL	PROXIMAL	
Age Gender Personality Neurobiology/psychophysiology Developmental trajectories Psychopathology Emotional skills (awareness) Knowledge on emotions Socio-cultural aspects Beliefs about emotions Beliefs about self-efficacy	Affective: Valence Intensity/arousal Controllability Location/activity, etc. Social context Frequency of recurrence	Cognitive: Effort/resources Presence of defaults
	Motivational: Goals: short and long term Anticipation	

2. First attempts to measure flexibility: questionnaires

From the recent theoretical frameworks described above (Aldao et al., 2015; Bonanno & Burton, 2013; Gross, 2015), flexibility has been set as a core feature of an efficient ER and one major challenge has been determining how to measure it; some examples are given hereafter.

The first set of studies tried to develop questionnaires targeting this process. The Self-Perception of Flexible Coping with Stress scale (SFCS; Zimmer-Gembeck et al., 2018) focuses on the perceived ability of flexibility, that is, to which extent individuals think they are able to apply and vary strategies to deal with their stress. It comprises three subscales, ‘multiple coping strategy use’, ‘situational coping’, and ‘coping rigidity’. Even if this scale evaluates the self-reported ability to vary strategies (e.g., ‘*It is best to try many different ways of coping with a stressor*’), it is limited to measuring variability without addressing the interaction between strategy choice and context.

The Cognitive Control and Flexibility Questionnaire (CCFQ; Gabrys et al., 2018) comprises two subdimensions, ‘cognitive control over emotion’ and ‘appraisal and coping flexibility’. Even though some items reflect at least part of flexibility (e.g., ‘*I weigh out many options before choosing how to take action*’), most of them rather evaluate common strategies such as ‘*I manage my thoughts or feelings by reframing the situation*’. Since flexibility implies covariation between strategy choice and context, we can wonder whether such questionnaires are appropriate since they refer to behaviours in general. For instance, an individual scoring very high in trying various strategies when confronting with a stressor might face difficulties in applying qualitatively a strategy well-suited for a given context. Consequently, while those scales measure partly variability in ER strategies, they give little information about whether such variability is adapted to context (i.e., flexibility). As such, others have begun to develop measures that incorporate contextual characteristics.

On a daily assessment approach, the Coping Flexibility Questionnaire (CFQ; Cheng, 2001) was developed and assesses the most stressful event an individual experienced on a specific day. Participants have to rate the event’s desirability, impact, and controllability on a 6-point scale. After describing the event, participants have to report all the strategies they employed before classifying them between problem-focused and emotion-focused goals. The last step requires participants to indicate the effectiveness of the strategy on a 6-point scale, from 1 ‘*very ineffective in bringing about the primary goal*’ to 6 ‘*very effective in bringing about the primary goal*’. This scale is administered one time per day for several days (similar to a daily diary design) and, as such, allows one to measure the strategy-situation fit of ER as well as the efficacy of such fit to achieve one’s goal. However, the strategy-situation fit here is limited to applying (1) problem-focused strategies in controllable situations and (2) emotion-focused strategies in uncontrollable situations. Although it provides information on controllability as an influential contextual feature, it prevents us from evaluating various

characteristics of context, and it accordingly captures a reduced picture of flexibility. Questionnaires per se do not sound appropriate to measure the dynamic concept of flexibility, most of them failing to measure both context and strategy variabilities. Consequently, another set of questionnaires has been under the scope of delineating components that compose ER flexibility.

In line with Bonanno et al.'s framework, three questionnaires are of primary interest to measure flexibility components. The Context Sensitivity Index (CSI – Bonanno et al., 2020) evaluates the ability to detect both cue absence and cue presence, i.e., context-sensitivity, in a scenario-based scale. Facing each scenario (e.g., *'A friend calls and asks you to do a favour for their partner whom you don't like'*), participants have to rate five dimensions (i.e., control-self, control others, urgency, cooperation, threat), from 1 'not at all' to 7 'very much' (e.g., *'How much control do you have over what happens next?'*)⁶.

Concurrently, the Flexible Regulation of Emotional Expression scale (FREE scale; Burton & Bonanno, 2016) proposes standardised hypothetical scenarios that were designed to measure the perceived ability to modulate emotional expressions upward and downward (i.e., repertoire). The last component of flexibility (i.e., feedback) can be assessed by the Coping Flexibility Scale (CFS; Kato, 2012), which measures both the ability to (1) discontinue an ineffective strategy and (2) produce and implement an alternative strategy. One limit of this scale is that some items of the evaluating coping subscale refer to re-evaluation and meta-coping (e.g., *'After coping with stress, I think about how well my ways of coping with stress worked or did not work'*) (Kato, 2020). Also, other studies have found low alphas for the evaluating coping subscale (e.g., .40 in Southward & Cheavens, 2017). Therefore, this scale was revised (CFS-R; Kato, 2020) to comprise three subscales: abandonment (e.g., *'I do not repeat using a coping*

⁶ These dimensions refer to the cognitive appraisal component of emotion described in Scherer's Component Process Model of Emotion (Appraisal theory; Scherer et al., 2001), such as controllability, urgency, and threat (Sander et al., 2005).

strategy that made the situation worse’) and re-coping (i.e., referring to past evaluative coping subscale; e.g., ‘If the situation has not improved, I consider different coping strategy’), and meta-coping (i.e., ability to monitor and to provide feedback on the effects of each coping flexibility process; e.g., ‘I know if a coping strategy has been successful or unsuccessful’). See Table 3 for a summary of flexibility questionnaires.

Table 3

Psychometric properties of ER flexibility questionnaires from English versions

SCALES	ITEMS	SUBSCALES	Subscales Alphas	Trr
SFCS	18	Multiple coping strategy use	.91	
		Coping rigidity	.79	-
		Situational coping	.71	
CCFQ	18	Cognitive control	.90	-
		Appraisal and coping flexibility	.89	
CSI	20 scenarios	Cue presence index	-	-
		Cue absence index	-	
FREE	16 scenarios	Enhance positive	.77	
		Enhance negative	.65	
		Suppress positive	.68	-
		Suppress negative	.66	
CFS	10	Evaluating coping	.71-.91	.73
		Adapting coping	.83-.90	.71
CFS - R	12	Abandonment	.87	.75
		Re-coping	.92	.76
		Meta-coping	.86	.81

Note. Trr: test-retest reliability.

Both the CSI and the FREE scale have been identified as promising measures of specific flexibility components (Bonanno et al., 2020; Bortolon et al., 2023) that we have decided to translate and validate in French.

3. Study 2: French validation of the CSI and FREE scale

French validations of the Context-Sensitivity Index (CSI) and the Flexible Regulation of Emotional Expression (FREE) scale.⁷

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Preregistration, data, material, Rscripts and supplementary material: <https://osf.io/6enk7/>

⁷ This version of the article was adapted to avoid repetitions with the Chapter.

Abstract

Background. ER flexibility is defined as the ability to match ER strategies to situational demands. Several components of flexibility have been identified, such as the ability to detect the presence or absence of contextual cues (i.e., context-sensitivity), the ability to use flexibly diverse strategies (i.e., repertoire), and the ability to monitor and adapt strategies (i.e., feedback). The goal of this study was to validate French versions of the Context-Sensitivity Index (Bonanno et al., 2020) and the Flexible Regulation of Emotional Expression (FREE) scale (Burton & Bonanno, 2016). **Method.** This online study comprised questionnaires designed to analyse the psychometric properties of the two questionnaires in a French population (N=397). **Results.** Both scales show satisfactory internal consistency, convergent validity and acceptable test-retest validity. Our findings support the hierarchical and four-dimension structures of the FREE scale, with all approximate fit indices demonstrating adequate model fit. **Limitation.** Common limits of self-reported measures are associated with this study. Moreover, our results should be replicated in future studies. **Conclusions.** The French versions of the CSI and FREE scale can be considered as reliable instruments for assessing context-sensitivity and repertoire as components of ER flexibility.

Keywords: emotion regulation, emotion regulation flexibility, assessment, validity, reliability.

Introduction

The ability to switch strategies depending on context refers to ER *flexibility* or *regulatory flexibility*. Bonanno et al. define regulatory flexibility through three major components: (1) the ability to detect the absence and/or presence of contextual cues (i.e., *context sensitivity*), (2) the number of strategies that an individual is able to apply when needed (i.e., *repertoire*), and (3) the ability to monitor the applied strategy and to use feedback to adapt and possibly switch to another strategy if necessary (i.e., *feedback*) (Bonanno et al., 2004; Burton & Bonanno, 2016). These three components are considered as fundamental abilities to appropriately select a strategy according to the context (i.e., *ER flexibility*; Aldao et al., 2015).

In order to assess components of ER flexibility, Bonanno et al. (2004) developed a laboratory-based paradigm aiming at capturing the repertoire component by assessing individuals' ability to both enhance and suppress their emotional expression, while facing pleasant and unpleasant images (*Expressive Flexibility Paradigm*; Bonanno et al., 2004). This paradigm has been implemented in various studies (Gupta & Bonanno, 2011; Westphal et al., 2010), which have shown that higher expressive flexibility (i.e., the ability to both suppress and enhance emotion expression when needed) predicted better self-adjustment and reduced distress (Bonanno et al., 2004; Westphal et al., 2010).

Although laboratory-based paradigms inform us about ER flexibility processes with experimental control, some authors consider that they are artificial, limiting ecological generalisation. However, almost all questionnaires assessing ER lack ecological features and focus mostly on the *frequency* with which individuals report using a given or several strategies, without considering context (e.g., Emotion Regulation Questionnaire - ERQ; Gross & John, 2003). This contrasts with recent models of ER flexibility that focus more on the *ability* to apply various strategies (i.e., having a large repertoire) in varying contexts (Bonanno & Burton, 2013; Chen et al., 2018).

To address the lack of measures assessing repertoire in terms of the ability to suppress and increase emotion expression in a more ecological perspective, Bonanno et al. have developed the Flexible Regulation of Emotional Expression scale (FREE, Burton & Bonanno, 2016). The FREE scale was developed using scenario-based items, evaluating the *perceived ability* (instead of the *frequency*) to express more (i.e., *enhancement* dimension) or conceal emotions (i.e., *suppression* dimension), depending on the situation. Results suggest a hierarchical structure with two higher-order factors (i.e., *enhancement* and *suppression*), both comprising *positive* and *negative* emotional contexts (CFI = .919, RMSEA = .055, $p < .001$) (Burton & Bonanno, 2016). Also, they found that each factor of the FREE was significantly associated with its dimension of reference in their experimental paradigm (Burton & Bonanno, 2016). Finally, internal consistencies were acceptable for both the *enhancement* and *suppression* dimensions (respectively, $\alpha = .81$ and $.70$).

Studies using the FREE have found that the *enhance* ability was inversely associated with depression and stress and that the *suppression* ability had the same association with depression, anxiety, and stress (Lenzo et al., 2021). Another study by Chen et al. (2018) also found that *suppression* ability was negatively associated with depression and anxiety and *enhancement* ability positively with life satisfaction. These findings emphasise the usefulness of the scale, as well as its good psychometric properties.

In order to measure other components of the model, Bonanno et al. (2020) also developed a specific measure of *context sensitivity* (Context Sensitivity Index - CSI). The CSI was developed in line with the major importance recently attributed to context in ER. Using 20 scenario-based items, it evaluates the extent to which an individual is able to detect (1) the presence of contextual cues (*Cue Presence Index*) and (2) the absence of contextual cues (*Cue Absence Index*). For each scenario, individuals have to rate five appraisal dimensions (i.e., perceived self-control, perceived control of others, perceived urgency, perceived need for

cooperation, and perceived threat). As this scale is scenario-based, items can be considered as causal indicators (each item represents a precise aspect of the construct), and thus, neither factor analysis nor internal consistency was performed (see Bonanno et al., 2020 for further explanations). Instead, they identified scenarios that showed clear consensus for the presence or absence of cues in three different samples (Study 1, 2, 3, Bonanno et al., 2020). They tested the convergent and discriminant validity and compared the questionnaire to an experimental task. Their validation study indicates that the *Cue Presence Index* was significantly associated with other measures of flexibility (i.e., FREE and CFS): individuals who are more sensitive to contextual cues show greater ability to flexibly express/suppress their emotions, to monitor and adjust strategies. Moreover, they found a significant association between this dimension and a behavioural task (*Picture Arrangement test – WAIS III*), in which participants have to reorganise picture cards to match a simple story.

Recent studies have found that the ability to detect contextual cues, measured by the CSI, was inversely associated with depression and anxiety in a population of healthcare workers (Lenzo et al., 2021). Used in combination with other components, Chen and Bonanno (2021) identified different individual profiles (using Latent Profile Analysis) based on the three components of flexibility. Their results indicated that individuals with inflexible profiles specifically in context-sensitivity (*‘Context Irresponsive Regulators’*) reported higher depressive and anxious symptoms in comparison to inflexible profiles related to low feedback abilities (*‘Feedback Insensitivity Regulators’*). Overall, these findings highlight the relevance of such a scale measuring context sensitivity.

Finally, Kato (2012) has developed a scale that can be used to measure the third component, i.e., *feedback responsiveness*, which captures the ability to discontinue an ineffective strategy (i.e., *evaluating coping* dimension) and to adopt an alternative one (i.e., *adaptive coping* dimension). However, this scale suffers from important limitations. First,

several items of the evaluating coping subscale refer to re-evaluation and meta-coping (e.g., ‘*After coping with stress, I think about how well my ways of coping with stress worked or did not work*’) (Kato, 2020). Second, other studies have found low alphas for the evaluating coping subscale (e.g., .40 in Southward & Cheavens, 2017).

The present study

Overall, Bonanno et al.’s studies have shown that both the CSI and the FREE represent promising tools to capture major components of ER flexibility. Therefore, the aim of the current study is to translate and validate French versions of the two questionnaires in a longitudinal design composed of two-time measurement (one-month interval).

Following the original English version of the scale, we expected that the hierarchical and four-factor structures for the FREE would display a better fit to our data compared to two bi-factor solutions (based on the valence, i.e., positive or negative scenario, or based on the type of expression, i.e., suppression or enhancement). Moreover, we expected an acceptable internal consistency, similar to previous studies (enhancement $\alpha = .81$ and suppression $\alpha = .70$; Burton & Bonanno, 2016). We also expected that the FREE scores would be positively correlated with a measure of feedback responsiveness, with an ER strategies measure and context-sensitivity.

Internal consistency and factorial analysis were not conducted for the CSI because the items comprising the scale were causal indicators rather than effect indicators (see Bonanno et al., 2020). As in Bonanno et al. (2020), we expected that the CSI scores would be positively correlated with the two measures of flexibility (i.e., repertoire and feedback) and the ER strategies measure. Additionally, we expected that the scores from both the FREE and CSI would be negatively correlated with measures of psychopathology, i.e., depressive and borderline symptoms, considering the ER disturbances often associated (Daros et al., 2019; Fresco et al., 2006). We finally hypothesised a temporal stability for the two scales between our two points of measure (one month between).

Method

Participants

Sample size calculation for SEM is based on the overall model fit and/or based on the association among the latent variables. Using the generated R code, a minimum sample size required to achieve a given level of power for testing a covariance structure model using RMSEA (testing close to fit hypothesis) was computed (Preacher & Coffman, 2006). The code parameters are set at $\alpha = .001$, $df = 179$, desired power = .80, Alternative RMSEA = .08 (RMSEA > .08 is generally interpreted as poor fit), and Null RMSEA = .055 (based on the study by Burton & Bonanno, 2016) required a sample of 215 participants. These sample size calculations were based on the models proposed by MacCallum et al. (1996). In order to take into account potential partial responders, an additional 30% was added to the calculation for a more definitive required sample size of 280 participants. Given the online administration and longitudinal design of this study, we aimed to recruit approximately 400 participants in T1 to limit attrition at T2.

To evaluate the psychometric properties of the French versions of the CSI and the FREE, a sample of 404 French participants was recruited from the general population. Participants were recruited with the help of ads on social media platforms (e.g., Facebook) and the university intranet. Acquaintances were requested to spread the word to their colleagues, family, and friends.

Participants were included if they were French speakers and at least 18 years old. Conversely, they were excluded if they failed two or more attentional checks dispersed throughout the online survey to control for careless responders. Three attention checks were included in the survey. A first attentional check requested participants not to answer a question (*'This question is an attentional check. Please do not answer the sports question that follows. Which of the following sports do you like?'*). The two other attention checks requested

participants to select a specific response (e.g., ‘Please, select 0. Not at all’). Seven participants were excluded for failing two of the three checks, giving a total sample size of 397 participants at T1. This study was approved by the ethics committee n° *Unistra/CER/2022-31*.

Translation and Back-translation Procedure

The CSI and the FREE were translated into French by following Sousa and Rojjanasrirat’ guidelines (Sousa & Rojjanasrirat, 2011) and based on original English versions of the questionnaires (Bonanno et al., 2020; Burton & Bonanno, 2016).

The first translations in French were executed by two bilingual translators (CN & MP) and compared to create a preliminary French version of the questionnaires. Subsequently, a back-translation (French to English) was conducted by two other translators (CB & LW). The resulting back-translated English versions were compared to the original English versions. Differences between the two English versions (original vs back-translated) were discussed and accordingly modified in the French version. These preliminary versions were then piloted by being administrated to a sample of 47 participants (from the French general population), who rated instructions and items on their degree of clarity. The French translated measures were then adapted based on the participants’ feedback.

Another second pilot study was conducted to assess convergence between the English and French versions. Bilingual participants (N = 103) completed the English version first (with additional questions to ensure their bilingualism) and were sent the French version one week later. All scores and items were positively correlated between the two versions (see Supplementary material).

All the translation steps have been recorded in files that are available in OSF: <https://osf.io/6enk7/>

Measures

Participants were asked to provide demographic information including their gender, age, level of education, medical data (i.e., current and past psychiatric diagnosis, current psychiatric medication). In addition to the CSI and FREE scale, the following questionnaires were presented.

Coping Flexibility Scale - CFS (Kato, 2012): The CFS is composed of 10 items measuring the ability to abandon an inefficient strategy and to engage in an alternative one. The Likert scale ranges from 1 ‘Not applicable’ to 4 ‘Very applicable’. The CFS comprises 2 dimensions, Evaluation and Adaptive coping, united under a total score of feedback reactivity. The internal consistency in the original article was of .90 for the Evaluation subscale and of .88 for the Adaptive coping subscale. In the current study, the internal consistency was respectively of .45 and .88, and of .82 for the total scale.

Emotion Regulation Questionnaire – ERQ (Gross & John, 2003): The ERQ is a scale that includes 10 items assessing ER strategies and more specifically those of expressive suppression (4 items – inhibition of emotional response) and cognitive reappraisal (6 items – evaluation of a situation allowing to reduce or increase its emotional expression). Each item is answered on a seven-point scale ranging from 1 ‘Not at all’ to 7 ‘Completely’. The internal consistency of the reappraisal and suppression subscales was of .79 and .73 respectively in the original study. In the current study, the internal consistency was respectively of .82 and .82.

Depression, Anxiety and Stress scale - DASS-21 (Lovibond & Lovibond, 1995): The DASS measures stress, anxiety, and depressive symptoms using 21 items, and comprises 3 dimensions: Depression, Anxiety and Stress. Answers are taken on a Likert scale ranging from 0 ‘Did not apply to me at all’ to 3 ‘Applied to me very much or most of the time’. In the original study, the internal consistency was of .91 for Depression, .81 for Anxiety and .89 for Stress. In the current study, we used the total score of the DASS to measure anxious and depressive

symptoms. In the current study, the internal consistency was respectively of .89, .85 and .84 and of .94 for the total scale.

Borderline Symptoms List - BSL-23 (Bohus et al., 2007): The BSL includes 23 items measuring the intensity of borderline symptoms (e.g., dysphoria, self-destruction, loneliness) experienced over the last week using a Likert scale ranging from 0 ‘Not at all’ to 4 ‘Very strong’. In the original study, the internal consistency was of .97. In the current study, the internal consistency was of .94.

Attention checks: In order to ensure the validity of participants’ answers, seven attentional check items were distributed throughout the entire survey. Items aimed to detect random completion or attention lapses and lies (e.g., ‘please answer 4 to this question’, ‘please, do not answer to this question’). The exclusion criteria were applied if two or more of these questions were not correct.

Procedure

Participants completed a web-based survey in *Limesurvey*, at two different time points. At the first time point, after having given their informed consent, they completed the questionnaires in a randomised order: sociodemographic data, ERQ, BSL-23, DASS-21, CFS, CSI and FREE. Then, participants were redirected to an independent page to provide their email addresses in order to be contacted for the second part of the study and to keep questionnaire endorsements separate from their identifiable data and, thus, maintain confidentiality. One month later, participants were asked to fill in the informed consent, sociodemographic data, FREE and CSI. The study preregistration, material, data, and R scripts are available on OSF: <https://osf.io/6enk7/>

Statistical analyses

All analyses were performed in R and Rstudio version 2021.09 (Rstudio Team, 2022). Normality was explored using the *Shapiro.test* function from the *stats* package (RcoreTeam, 2013). Confirmatory factor analyses (CFA) were conducted using the *Lavaan* package, to test the four-factor and hierarchical structures of the FREE. These models were compared to two bi-factor models (one emotion-based, one type of expressivity-based). Model fit was ascertained using the chi-square statistic and goodness of fit indicators. The Comparative Fit Index (CFI) and the Tucker and Lewis Index (TLI) values are indicative of a good fit when ranging from .90 to .95 and a very good fit when values are above .95 (Hu & Bentler, 1999). The Root Mean Square Error of Approximation (RMSEA) and its 90% confidence interval (CI) is indicative of acceptable when values are less than .10 (Williams, 2011). The Standardized Root Mean Square Residual (SRMR; Browne, 1993) is defined as the standardised difference between the observed correlation and the predicted correlation, and points to good fit when values are below .08 (Hu & Bentler, 1999). Model comparisons were examined using the χ^2 difference test.

The validity and reliability of the French version of the FREE and CSI were tested through multiple analyses. First, internal consistency was analysed through omegas for the FREE (Dunn et al., 2014; Flora, 2020; McDonald, 1981). Subsequently, Pearson correlations were used to evaluate the test-retest reliability for the two FREE and CSI scores. Convergent validity was also analysed through Pearson correlations by comparing scores between the CSI, the FREE, the ERQ, the DASS and the BSL-23. Benjamini Hochberg's correction was applied (Hochberg & Benjamini, 1990).

Results

Descriptive data

The majority of participants did not report any diagnosis (86.9%), nor medication intake (84.6%). At one-month interval, 203 (51.13%) participants responded to the FREE and CSI again for the test-retest analysis, with no different indicators regarding sociodemographic data of the entire sample. Further details on descriptive data are available in Table 1.

Table 1*Descriptive data*

		T1 (N = 397)				T2 (N = 203)			
		<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
CSI									
	<i>Cue presence</i>	51.2	8.25	10	67	50.0	7.83	13	68
	<i>Cue Absence</i>	50.2	7.73	28	70	49.3	7.70	31	68
	<i>Context Sensitivity</i>	101	9.52	70	128	99.3	9.59	68	121
FREE									
	<i>Suppression</i>	3.81	0.85	1	6	3.75	0.85	1.25	6
	<i>Enhancement</i>	4.07	0.89	1	6	4.11	0.82	1.75	6
	<i>Repertoire</i>	7.87	1.37	2	12	7.86	1.28	3.25	12
CFS									
	<i>Evaluation</i>	8.82	2.32	2	15	-	-	-	-
	<i>Adaptation</i>	9.26	3.34	0	15	-	-	-	-
	<i>Feedback Responsiveness</i>	18.1	5.08	3	30	-	-	-	-
ERQ									
	<i>Reappraisal</i>	27.2	7.56	6	42	-	-	-	-
	<i>Suppression</i>	13.7	6.08	4	28	-	-	-	-
BSL-23		0.75	0.69	0	3.65	-	-	-	-
DASS-21		18.9	12.9	0	59	-	-	-	-
Age		34.4	14.7	18	73	37.19	15.0	18	72
Gender		N	%			N	%		
	<i>Men</i>	73	18.4			43	21.2		
	<i>Women</i>	321	80.9			159	78.3		
	<i>Other response</i>	3	0.8			1	0.5		
Education									
	<i>Secondary</i>	1	0.3			1	0.5		
	<i>High school</i>	61	15.4			33	16.3		
	<i>Bachelor</i>	121	7.1			65	32.0		
	<i>Master</i>	186	46.9			94	46.3		
	<i>PhD</i>	28	7.1			10	4.9		

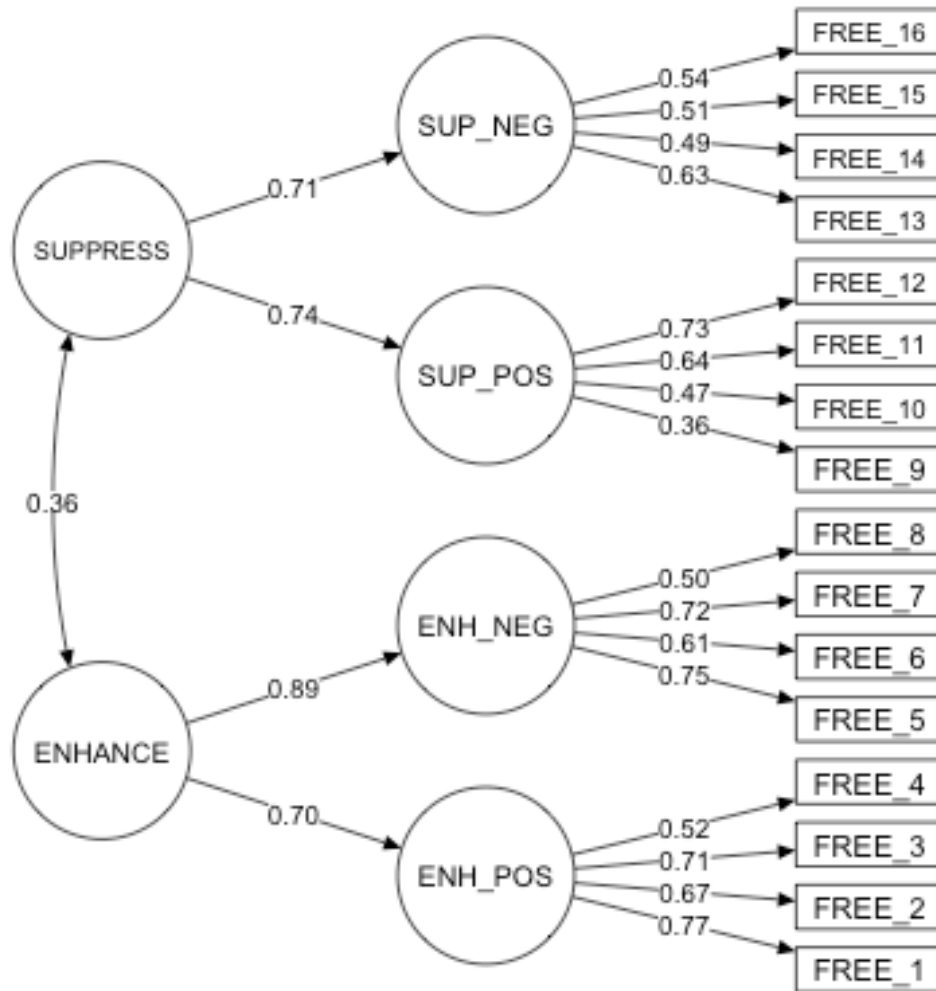
Note. CSI: Context Sensitivity Index (Bonanno et al., 2020); FREE: Flexible Regulation of Emotional Expression scale (Burton & Bonanno, 2016); CFS: Coping Flexibility Scale (Kato, 2012); ERQ: Emotion Regulation Questionnaire (Gross & John, 2003); BSL-23: Borderline Symptoms List 23 (Bohus et al., 2007); DASS-21: Depression, Anxiety and Stress Scale (Lovibond & Lovibond, 1995).

Confirmatory analysis for the FREE

The two-factor model by emotion type showed a poor model fit (CFI = .66; RMSEA = .11; $\chi^2 = 553.534$, $df = 103$, $p < .001$). The two-factor model by strategy type also showed an inadequate model fit (CFI = .79; RMSEA = .08; $\chi^2 = 1450.656$, $df = 120$, $p < .001$). The four-factor model showed an adequate model fit (CFI = .94; RMSEA = .05; $\chi^2 = 1450.656$, $df = 120$, $p < .001$), as did the hierarchical four-factor model (CFI = .94; RMSEA = .05; $\chi^2 = 1450.656$, $df = 120$, $p < .001$) (see Figure 1); following the recommendations of Hu and Bentler for the interpretation (1999). The results from the chi-square differences tests between the two four-dimension models were non-significant ($\Delta\chi^2 = 0.538$, $\Delta df = 1$, $p = 0.46$), supporting similarly good fit for both the independent four-factor and the hierarchical four-factor models. All standardised regression estimates were moderate to high (see Figure 1) and all values were significant at $p < .001$.

Figure 1

Standardised factor loadings for hierarchical model of the FREE scale ($p < .001$ for all weight values)



Internal consistency of the FREE and test-retest reliability for the FREE and CSI

The total translated FREE scale has high internal consistency, with an omega of .82. Internal consistency was also good for the Enhancement and Suppression subscales, with omegas of .85 and .78, respectively. The omegas of the negative dimension are of .76 for enhancement and of .64 for suppression. The omegas of the positive dimension are of .78 for enhancement and of .71 for suppression. As expected, the subscales of the FREE showed

significant associations, with small to strong correlations between them ($r = .14 - .89$) (See Table 2).

Test-retest reliability ($N = 203$) for the FREE and CSI over a period of one month was strong for the total scales, and adequate for all subscales, with coefficients ranging from .65 to .82 for the FREE. For the CSI, the Cue absence coefficient was of .74, Cue presence .77 and total score .71 ($p < .001$). Additionally, all items from the two scales were highly and significantly correlated between the two measurement points (see Supplementary material).

Table 2

FREE descriptive data

Scale	ω	Test-retest ($n = 203$)	1	2	3	4	5
Enhance POS	.78	.65**	-	-	-	-	-
Enhance NEG	.76	.65**	.51**	-	-	-	-
Suppress POS	.71	.76**	.18**	.16**	-	-	-
Suppress NEG	.64	.79**	.14*	.17**	.40**	-	-
Enhancement	.85	.68**	.85**	.89**	.20**	.18**	-
Suppression	.78	.82**	.19**	.20**	.83**	.84**	.23**
Total score	.82	.81**	.67**	.70**	.65**	.64**	.79**

Note. ω : omega; *: $p = .001$ (after B. Hochberg's correction); **: $p < .001$; *: $p < .01$.

Convergent validity

Correlations for convergent validity are reported in Table 3. Firstly, as expected, the FREE and the CSI were mildly but significantly correlated with each other ($r = .13, p = .01$) and with the CFS ($r = .15$ and $.17, p < .01$). Specifically, the CFS-Adaptive coping subscale was positively associated with CSI-Presence and with each subdimension of the FREE. The CSI-presence and CSI-absence were negatively associated ($r = -.29, p < .01$). The FREE and

the CSI-presence only were positively associated with the ERQ-Reappraisal. Only the FREE-Suppression was positively associated with ERQ-Suppression. Interestingly, the CSI-Presence was positively associated with the BSL-23 and DASS-21 total score, but negatively with the CSI-Absence. The DASS Stress subscale was negatively associated with Suppression and CSI-Absence and positively with CSI-Presence. The DASS Anxiety subscale was negatively associated with CSI-Absence and CSI-total score. The DASS Depression subscale was negatively associated with CSI-Absence.

Table 3

Correlations between the scales for convergent validity

Scales	CFS	CFS-Evaluation	CFS-Adaptive coping	ERQ_R	ERQ_S	BSL	DASS-total score	DASS-stress	DASS-anxiety	DASS-depression
FREE-Enhance	.14**	.06	.17**	.10	-.09	.00	-.04	-.03	.00	-.07
FREE-Suppress	.10*	.05	.12*	.10	.20**	-.03	-.09	-.12*	-.08	-.03
FREE-Total	.15*	.07	.19**	.12*	.06	-.02	-.08	-.10	-.05	-.07
CSI-Presence	.15*	.09	.16*	.12*	.02	.12*	.10*	.14*	.06	.07
CSI-Absence	.05	.04	.05	-.04	-.08	-.17**	-.22**	-.19**	-.21**	-.17**
CSI-Total	.17**	.12*	.18**	.08	-.04	-.03	-.08	-.03	-.12*	-.08

Note. *: after B.Hochberg's correction, $p < .049$; **: $p < .001$; ERQ-R: Emotion Regulation Questionnaire – Reappraisal; ERQ-S: Emotion Regulation Questionnaire – Suppression; DASS: Depression, Anxiety and Stress Scale; BSL: Borderline Symptoms List; CFS: Coping Flexibility Scale.

Exploratory analyses: testing measurement invariance across cultures

By accessing the original data from the FREE (Burton & Bonanno, 2016), we were able to conduct multi-group CFA to test the measurement invariance between the French and US samples on the hierarchical structure. We combined the two samples from the original study with the current sample, comparing three models. Model 1 imposed no equivalence restriction (configural model), Model 2 assumed that factor loadings were the same across samples (weak

invariance model), and Model 3 assumed that both factor loadings and intercept of the latent factor were the same (strong invariance model).

Fit indices from the measurement invariance tests across French and US samples were acceptable in all models. Results from the ΔCFI (all $\leq .01$, see Cheung & Rensvold, 2002) supported the weak (loadings) invariance of the hierarchical model of the FREE across French and US samples (Van de Schoot et al., 2015). However, the strong (intercepts) invariance was not supported (see Supplementary material).

Discussion

The goal of the current study was to validate the French versions of the CSI and FREE scale by assessing its psychometric properties in a French general population. Our study included 397 individuals and revealed that the French versions of the two scales demonstrate adequate psychometric properties and, thus, can be used in French samples as a reliable instrument assessing flexibility in emotional expression and context-sensitivity, respectively.

Indeed, the confirmatory factor analysis for the FREE provides support for a four-factor solution, whether independent or hierarchical. This is in line with previous factorial analysis of this scale (Burton & Bonanno, 2016), indicating that the questionnaire measures enhancement and suppression abilities for both positive and negative emotions. This highlights that individuals' regulatory ability to modify their emotional expression is dependent on the context (here, positive or negative) while simultaneously related by a common factor (e.g., overall strategy), giving further evidence for Bonanno's model of regulatory flexibility. Our exploratory analysis to examine measurement invariance of the FREE between the French and US samples provided support for partial invariance. The configural and metric models provided evidence that the underlying factor structure and factor loadings were consistent across the two cultures, suggesting that the scale measures the same constructs in both groups. However, the

significant difference in scalar invariance indicates that there is a systematic variation in the intercepts of certain items between the cultures, highlighting cultural differences in the way individuals interpret and respond to at least some of the FREE items.

Moreover, our study reproduced Burton and Bonanno's (2016) results regarding the internal reliability of both the total score and subscales of the FREE. Stability over time for both context-sensitivity and repertoire measures showed good test-retest validity for the total scales ($r = .71$ for the CSI and $.81$ for the FREE), and acceptable reliability for the subscales (from $r = .61$ to $.82$). Being sensitive to context and flexibly regulating emotional expression seems to be relatively stable over time, which is consistent with studies showing behavioural expressive flexibility to be stable as well (Westphal et al., 2010). However, they are here measured with the controlled scenarios, which prevents us from generalising these results to newly encountered situations.

The FREE and CSI were positively associated with each other as well as with a measure of feedback (excepted from the CSI absence subscale). This indicates that a greater ability to be flexible (using flexibly enhancement and suppression of emotional expression) and a greater sensitivity to the presence of contextual cues, the better adaptability in terms of feedback sensitivity, and specifically, with Adaptive coping. Despite being correlational, these results give further evidence of the interdependence between context-sensitivity and subsequent ER (repertoire) and monitoring of its results (feedback). This is in agreement with the original study's findings, which also show no association between Cue absence and feedback. This emphasises that detection of the absence and presence of cues can be considered orthogonal abilities, also supported by the negative correlation between Cue presence and Cue absence ($r = -.29, p < .001$).

Our results showed a positive association between a measure of general use of reappraisal (ERQ) and the FREE total score. Although the original study had found an

association with both subdimensions of the FREE, our results rather underline that a general use of reappraisal seems to be associated with an overall flexible use of both enhancement and suppression of emotional expression. Thus, reappraisal could be considered a cognitive marker of regulatory flexibility during an emotional episode since it enables individuals to perceive the situation with new perspectives and to adapt their expression or suppression of emotion according to the context, situational and individual issues at stake. Future studies could then focus on the link between cognitive flexibility, reappraisal, and flexible ER, and assess how these three dimensions relate to each other. For example, the ability to reappraise could contribute to cognitive flexibility (e.g., by increasing possibilities to switch between strategies), which in turn could allow flexible ER. This type of study would make it possible to integrate several concepts of flexibility and promote understanding. Indeed, the notion of flexibility is still a recent concept and has been addressed through diverging dimensions, such as cognitive or psychological flexibility (Cherry et al., 2021). The field would benefit from a clearer operationalisation, which remains an important issue for developing a theoretical background and therapeutic interventions.

Surprisingly, the general use of suppression, measured by the ERQ, was associated with expressive suppression, which contradicts the original study showing no association between suppression ability and frequent use of suppression, suggesting that the two represent different constructs (Burton & Bonanno, 2016). In contrast, our findings rather suggest that they are related constructs and that a greater ability to suppress emotional expression when needed may be associated with a greater tendency to use expressive suppression. Considering potential variability in the correlation coefficients (.13 in the original study and .20 in our sample, CI 95% [0.10 - 0.29]), the current significant association may have been facilitated by the larger size of our sample (N = 200 in the original study vs 376 in our sample), thus highlighting the relatedness between suppression ability and its frequency of use. Considering the correlational

nature of this association, it is possible to regard a high frequency of suppression use as a factor influencing the ability to apply suppression in the FREE (McRae et al., 2012). Thus, causal relationships remain to be tested in future studies to evaluate whether the ability to suppress may be driven by an increased use of the strategy (Chen et al., 2020).

Concerning the CSI, only the Cue presence dimension was positively associated with the frequent use of reappraisal. Although small, this correlation might be indicating an overlap between adaptive reappraisal in general and its use when assessing the presence of contextual cues (Kalokerinos & Koval, 2022). This makes sense considering that the CSI evaluates individuals' ability to correctly assess *they* have control in a situation (when they indeed have), when *others*, instead, have control of the situation, as well as when a situation really represents a threat, thus, requiring one to react fast.

Our measures of psychological difficulties (stress, anxiety, depressive symptoms, and borderline symptomatology) were found to be positively associated with the Cue presence dimension but negatively with the Cue absence dimension. This implies that the greater ability to identify the presence of contextual cues is associated with increased borderline and stress symptoms. As mentioned before, this scale measures the individual's ability to perceive that in the situation, they have the control over a situation and needs to act accordingly (when it is really the case). This perception might also represent a source of stress, especially if this conclusion is accompanied by an overall sense of lack of control, feelings of worthlessness and overall inability to manage real stressful situations as in borderline (as assessed with the BSL-23).

Conversely, the greater ability to detect the absence of cues is associated with decreased psychopathology (depression, anxiety, stress and borderline), as in the study by Bonanno et al. (2020). This may be the translation of an over-sensitivity to contextual cues (oversensitivity to threat) across disorders, emphasising that difficulties in detecting the absence of cues

(emotional reactivity) might be transdiagnostic (Bortolon et al., 2022; Nardelli et al., under review). This over-sensitivity could reflect the frequent state of alertness and threat experienced by individuals with psychopathological disorders. For example, research showed that, in the case of borderline personality disorder, individuals have a cognitive, and especially attentional, bias toward processing negatively-valenced stimuli (e.g., Carpenter & Trull, 2013). Thus, the validation of the CSI will enable future studies to explore the processing of contextual cues in psychopathology and how these contribute to the state of alertness and threat experienced by individuals suffering from mental disorders.

Surprisingly, none of the FREE dimensions were associated with either borderline or depressive symptoms (excepted from a negative association with stress), although the original study had found a negative association between depression and expressive suppression (with small effects). Considering previous evidence for the association between suppression frequency and borderline symptoms' severity (Chapman et al., 2009), our results indicate that borderline disorder symptoms do not seem to influence participants' ability to imagine themselves suppressing or enhancing their emotions; which is different from their actual ability to do so. Like before, considering potential variability in the correlation coefficients from one study to another (-.18 in the original study and -.10 in our sample for depression), the discrepancies between the two studies can be explained by the sample size. Thus, future studies are required with larger sample sizes and clinical populations to disentangle these associations.

Limitations

The results of this study must be interpreted considering its limitations. First, convergent validity was only assessed through self-report measures. Moreover, our study was associated with common recruitment bias, such as a majority of women (80.9%), although gender differences have been highlighted in the literature (Goubet & Chrysikou, 2019; Nolen-

Hoeksema et al., 2008). For example, an exploratory analysis separating men from women of our sample revealed that the association between the perceived ability to suppress the emotional expression and the frequent use of expressive suppression was only significant for the women subsample, which highlights the need to explore gender differences in future studies. This might explain some partial divergent results in our study compared to the previous one (Burton & Bonanno, 2016). Still, despite the differences in sample characteristics (Burton & Bonanno, 2016), our factorial structure replicated for the FREE scale.

Even though the questionnaires can give further information on ER flexibility, they nonetheless are limited by their assessment of what individuals *think* they would be able to do, as opposed to how they would actually behave, which can be reflected by the small correlation coefficients. Hence, as was done in the original reports on the CSI and FREE, future translation studies would benefit from comparing these indices with behavioural measures.

Furthermore, answers can be influenced by several biases, such as common memory bias or representations that people have at the time of the assessment (Aldao et al., 2010; Lane et al., 1998). For example, a significant correlation was found between the FREE questionnaire and social desirability ($r = .27, p < .01$) (Burton & Bonanno, 2016). Self-report questionnaires do not reflect an experience or behaviour but rather a judgement on these experiences that could be biased by the influence of time, beliefs, or factors associated with the current state of the person (Schwarz et al., 2009). Besides, gaps between retrospective and real-time measures are continuously reported in the literature. Lastly, these tools do not consider personally-relevant contextual variables, which prevents us from accurately measuring flexibility, yet fundamental to an efficient ER (Aldao et al., 2015). Therefore, experimental and daily designs seem to better suit ER dynamics measurement.

Conclusion

To our knowledge, this is the first study to validate French versions of the CSI and FREE scale, which can be considered reliable instruments in the field of ER flexibility measurement. Given that this study was conducted on a general population sample, future studies should aim to test these French versions in clinical samples.

4. Measuring emotion regulation as a dynamic process

To overcome the limitations associated with questionnaires and to better capture the dynamics of ER, experimental paradigms and daily methods have been designed. They are introduced in the next section and followed by a systematic review of these methods.

4.1. Experimental manipulations of emotion regulation

Experimental paradigms have been developed to overcome the limitations commonly associated with self-report measures. Most of these studies focus on the implementation stage by inducing emotion and asking participants to engage in an ER strategy, defined a priori in laboratory settings, and assessing the consequences (Aldao et al., 2010). They were first developed by Gross et al. (1998) using a disgust-inducing film to measure cognitive reappraisal and emotional suppression. A series of studies employed similar paradigms to study other ER strategies, such as rumination (e.g., Aldao, 2013), and avoidance (e.g., Aldao et al., 2016) in clinical and non-clinical samples. Other studies have focused on evaluating the efficacy of ‘adaptive’ strategies, such as the one conducted by Diedrich et al. (2014), who compared the differential effectiveness of self-compassion, cognitive reappraisal, and acceptance on depressed mood. Still, these studies have several limitations: they focused mostly on the

implementation stage, manipulated only a few strategies, did not consider the role of context, and employed a forced-choice paradigm (Demaree et al., 2006). A forced-choice paradigm prevents participants from selecting and implementing different or multiple strategies, limiting our understanding of an individual's capacity for ER flexibility. It also prevents capturing the determinants and consequences of ER choices. Indeed, ER strategies do not occur in isolation (Aldao & Tull, 2015). Therefore, to overcome some of these limitations, some studies proposed to assess ER strategies by varying the context (e.g., several levels of intensity in the emotional induction) and displaying several ER options (Aldao & Nolen-Hoeksema, 2012; Bonanno et al., 2004; Demaree et al., 2006; Sheppes et al., 2011; Troy et al., 2010, 2013). These designs allow us to isolate specific contextual features in highly controlled environments to examine ER subprocesses (e.g., selection of a strategy) and can give information on definite flexibility components (e.g., repertoire).

Despite the many strengths of these studies, these experimental paradigms reflect low ecological validity and provide only a few variations of context. Consequently, other studies have employed more ecological measures.

4.2. Daily measures of emotion regulation

The umbrella term 'daily assessments' comprises both ESM (Experience Sampling Method) and EMA (Ecological Momentary Assessment) methods. Although ESM theoretically refers to multiple measurement points during the day, whereas EMA refers to daily diaries (for example, at the end of the day), both terms are used interchangeably (Trull & Ebner-Priemer, 2014). Daily measures allow assessing the selection and monitoring of ER strategies in everyday life, several times per day, and during several days. They constitute a promising approach for catching natural variation of the individuals' context while limiting retrospective

bias (Barrett & Barrett, 2001; Rosenkranz et al., 2020). These two methods enable grabbing almost instantly individual processes and random temporal sampling of the individual's natural environment.

Most recently, researchers have started to design studies or analyse data in a way that considers ER flexibility, variability and, therefore, the context in which ER takes place. Many studies have employed ESM to explore to what extent ER and/or its effects (e.g., on well-being) vary according to the situation (e.g., English et al., 2017), controllability (Hamama-Raz et al., 2018), and goals (e.g., Millgram et al., 2019). Even if promising, most of these studies mainly assess the participants' repertoire of ER strategies (Aldao, 2013). Others have assessed only variability, considered as one requirement for flexibility according to Aldao et al.'s (2015) approach (e.g., Blanke et al., 2020). Indeed, Aldao et al. (2015) advocate assessing ER by considering the notion of variability with which a given strategy is used over time (within-strategy variability), the variability in the number of strategies employed (between-strategy variability), the extent to which this variability aligns with contextual demands (i.e., flexibility), and consequently, helps the individual to pursue their goals (adaptability). This involves assessing the situation in which an emotion occurred, the emotional experience, the goals pursued, the importance of these goals, the ER strategies employed, and their effectiveness in facilitating goal achievement (Aldao et al., 2015). Thus, measuring variability is another way to measure the ability to apply various strategies (i.e., repertoire) (Bonanno & Burton, 2013).

The ESM can thus be considered complementary to the usual measures but has certain limitations (Csikszentmihalyi & Larson, 2014). Indeed, these methods do not allow making causal inferences but are rather correlational (Haedt-Matt & Keel, 2011). Furthermore, using these self-reported measures could lead to changes in the behaviours measured, notably by increasing people's awareness of engaging in certain behaviours (*reactivity*, see Shiffman et al., 2008). These methods can be sources of burden for participants (Van Berkel et al., 2017), given

the quantity of information needed. Some factors - such as the number of items, the number of alerts, and question types - have to be cautiously studied to avoid these drawbacks (Klasnja et al., 2008). Also, the required equipment can be an issue because it requires mobile apps downloaded on participants' smartphones (e.g., PIEL) (Van Berkel et al., 2017).

4.3. Multiple indexes to account for a dynamic process

As defined by Aldao, Gross, and Sheppes (2015), an efficient ER requires variability, flexibility, and adaptability. From this perspective, the first step in computing ER flexibility is to measure variability by considering that (1) a given strategy can be applied variably in time and (2) different strategies can be applied successively (switch in strategies). Thus, a *within-strategy variability* index has been calculated⁸ and tested as a measure of ER dynamics (Aldao et al., 2015). However, this index does not enable researchers to disentangle what refers to an excessive or adaptive strategy-switching, limiting the measurement of ER flexibility and adaptiveness. Likewise, measuring *between-strategy variability*⁹ only (i.e., different strategies simultaneously) prevents us from determining the efficacy of ER and whether the regulation was adaptive or not.

Wenzel et al. (2021) proposed to study other measures of ER dynamics, arguing that ER variability does not give much information on temporal processes. Instead, they study ER *instability* (i.e., how the strategy-use changes from one time-point to the next), ER *inertia* (i.e., auto-regression between two time-points), ER *predictability* (i.e., searching for recurrent patterns of strategy-use over time), ER *differentiation* (i.e., ability to differentiate between different strategies), and ER *diversity* (i.e., measuring the individual's repertoire of strategies).

⁸ The within-strategy variability index is represented by the standard deviation or intra-class correlation between several time points for a given strategy (Aldao et al., 2015).

⁹ The between-strategy variability index is represented by the standard deviation or intra-class correlation between several strategies at one time point (Aldao et al., 2015).

Interestingly, their results indicate that ER between-strategy variability was the strongest predictor of lower negative emotions. Also, ER predictability was associated with decreased levels of negative emotion, suggesting that recurrent patterns of ER strategies over time are adaptive. Yet, those measures do not measure strategy-context fit but rather time dynamics in ER.

To measure ER *flexibility*, i.e., whether the strategies employed are adapted to contextual changes, one needs to choose which contextual changes must be considered. As discussed earlier in this chapter, different positions have been adopted to measure context. Some authors consider context as internal and/or external cues, such as personality traits, valence, emotional intensity, goals, location, activity, etc. One option proposed by Aldao et al. (2015) is to integrate these variables in multilevel analyses. Another way of assessing variation in context is to consider that it is naturally changing from time^x to time^{x+1} without evaluating specific contextual characteristics (e.g., McMahon & Naragon-Gainey, 2019). This method can be useful because it enables catching ER processes and dynamics in longitudinal analyses. However, it prevents us from identifying which specific contextual variable influences ER and whether the regulation was effective.

Measuring *adaptability*, i.e., the ability to match ER flexibility to the individual's goals, has mostly been used to determine whether different goals predicted different ER choices (e.g., Millgram et al., 2019). There is evidence of such pattern, with for instance participants choosing different strategies depending on whether they are motivated to increase or decrease their emotions (Millgram et al., 2019). Importantly, some authors argue that goals are the most influential contextual aspect of the ER choice (Tamir, 2016) and that ER goals can serve superordinate goals (*motives* – see Chapter 1, p.14). In other words, whatever situational cues an individual may face, the adaptiveness of ER could be directly dependent on their goals and their attainment. Measuring goals raises other questions, such as the possible distinction

regarding their temporality. Precisely, a *short-term* goal can be pursued (e.g., to lose weight) while itself being or not in concordance with a *long-term*, higher-order goal (e.g., to keep a healthy life) (Aldao et al., 2015; English et al., 2017; Tamir et al., 2020)¹⁰. This distinction also echoes Southward et al.' (2021) *effectiveness vs adaptiveness* distinction presented above (p.58). The association between strategies and goals appears essential since findings indicate that when people feel the emotions they desire, they report greater well-being (Ford et al., 2019; Tamir et al., 2013). In other words, goals shape whether, when, and how people regulate their emotions (Koole, 2009; Millgram et al., 2020). Even if the majority of people try to regulate their emotions for hedonic purposes, they can also do so for instrumental and social goals (Tamir, 2016). A main methodological difficulty is to identify the extent to which individuals are aware of their short/long-term goals and whether their goals are congruent with well-being.

In sum, several indexes have been developed in an attempt to measure ER flexibility. However, it seems they are all limited to some extent to catch the concept as a whole.

Still, many experimental and daily designs have been developed to measure ER dynamics. This observation led us to perform a systematic review to summarise and critically analyse the various possibilities in ER flexibility measurement, in both experimental and ESM/EMA designs. This review is presented in the following section.

¹⁰ The relationship between short-term and long-term goals also reflects how the goal system can comprise goals at different levels of abstraction (Kruglanski, 2004). From both the Construal-Level Theory (Trope & Liberman, 2011) and the Action Identification Theory (Vallacher & Wegner, 1987, 1989), goals implicated in ER can arise from actions' identification hierarchy, ranging from low-level to high-level identities. In this perspective, longer term goals in ER (or *motives* – Tamir, 2016) can be understood as high-level construal (i.e., superordinate mental representations).

5. Study 3: Systematic review of flexibility measures

Emotion regulation flexibility: A Systematic Review of experimental and daily measures¹¹.

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Supplementary material: <https://osf.io/kcu3b/>

¹¹ This version of the article was adapted to avoid repetitions with the Chapter.

Abstract

Emotion regulation (ER) flexibility has become the focus of attention in the field of emotion. As such, experimental and daily assessments have been designed to study how people regulate their emotions according to context. However, no review has tried to summarise and critically analyse the methodologies employed. The systematic review was conducted according to PRISMA guidelines and 4404 studies were identified. A total of 40 articles were included. Findings highlight the divergence of measures leading to a lack of consensus in the assessment of ER flexibility. We discuss our results by questioning the measures and broadening the thinking to heterogeneity in flexibility and context definitions. We propose that both experimental and daily designs should be used, systematically adopting within-participant analyses.

Keywords: emotion regulation flexibility, emotion regulation choice, experimental designs, ESM/EMA measures, systematic review.

Introduction

Based on Gross's initial work, many subsequent studies focused on understanding which ER strategies would contribute to or prevent psychopathology (Aldao et al., 2010). Typically, studies instructed participants to use an adaptive (e.g., reappraisal) and a maladaptive (e.g., suppression) ER strategy in laboratory settings and assessed the consequences. Overall, adaptive strategies lead to better outcomes in terms of positive emotion and reduced negative emotion when compared to maladaptive strategies (Gross, 1998, 2015). Nevertheless, recent research has started to question this division and the linear way ER has been explored so far.

For instance, Gross (2015) proposed that ER would result from interactions between different evaluative systems. ER would intervene when facing a gap between the representation of the world (current emotion) and the desired world (desired states or behaviours). Adaptive ER is now understood as the adjustment of strategies synchronised with changes in the context, i.e., flexibility. For instance, cognitive reappraisal would be preferable in situations of low emotional intensity, while distraction would be preferentially used in situations of high emotional intensity (Sheppes et al., 2009). All authors agree that the goal of ER would therefore be not to eliminate negative emotions in favour of positive ones but rather to influence the dynamics of each emotion to produce environmentally adapted responses (Aldao et al., 2015; Millgram et al., 2019). The capacity of flexibility would be adaptive in facilitating the pursuit of the individual's personal goals (Aldao et al., 2015; Eldesouky & English, 2018; Gross, 2015; Morris & Mansell, 2018) and, therefore, promoting mental health by helping individuals to cope with negative life events and stress (Bonanno, et al., 2004; Kashdan & Rottenberg, 2010).

The current systematic review

Different protocols have been developed to assess ER flexibility. However, there is a need to clarify the extent to which these protocols can be adequate measures of ER flexibility

in light of the current theoretical background. Therefore, our current goal is to perform a systematic review to identify different experimental and daily measures of ER flexibility. The notion of context will be considered as defined by Aldao et al. (2015), referring to the person's external context (e.g., location, social context) and/or responses to external stimuli (e.g., emotional intensity) and goals. The ultimate aim of this systematic review is to provide some guidelines for future research.

Method

This work was preregistered on the Open Science Framework website: <https://osf.io/kcu3b/>. This systematic review was conducted based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) recommendations (Moher et al., 2009).

Literature search strategies

Two databases (Pubmed and PsycINFO) were used to identify studies and verification was performed on Google Scholar, using the same keywords. Papers from 1998 and onwards were considered, given the increase in research on ER from this date, especially from Gross's work. Some authors were contacted to get access to full texts. The literature search was performed from 2021 to January 2022. A first selection of the papers used a combination of the keywords (i.e., in the title, abstract and keywords) (e.g., 'emotion regulation' AND 'flexibility') (see Supplementary material for a full list of words searched in the literature). After checking for duplicates (using Zotero software), titles and abstracts were evaluated according to criteria by one researcher. Doubts were discussed with two other researchers until final decisions. Then, the selection was applied according to the full texts.

Eligibility criteria

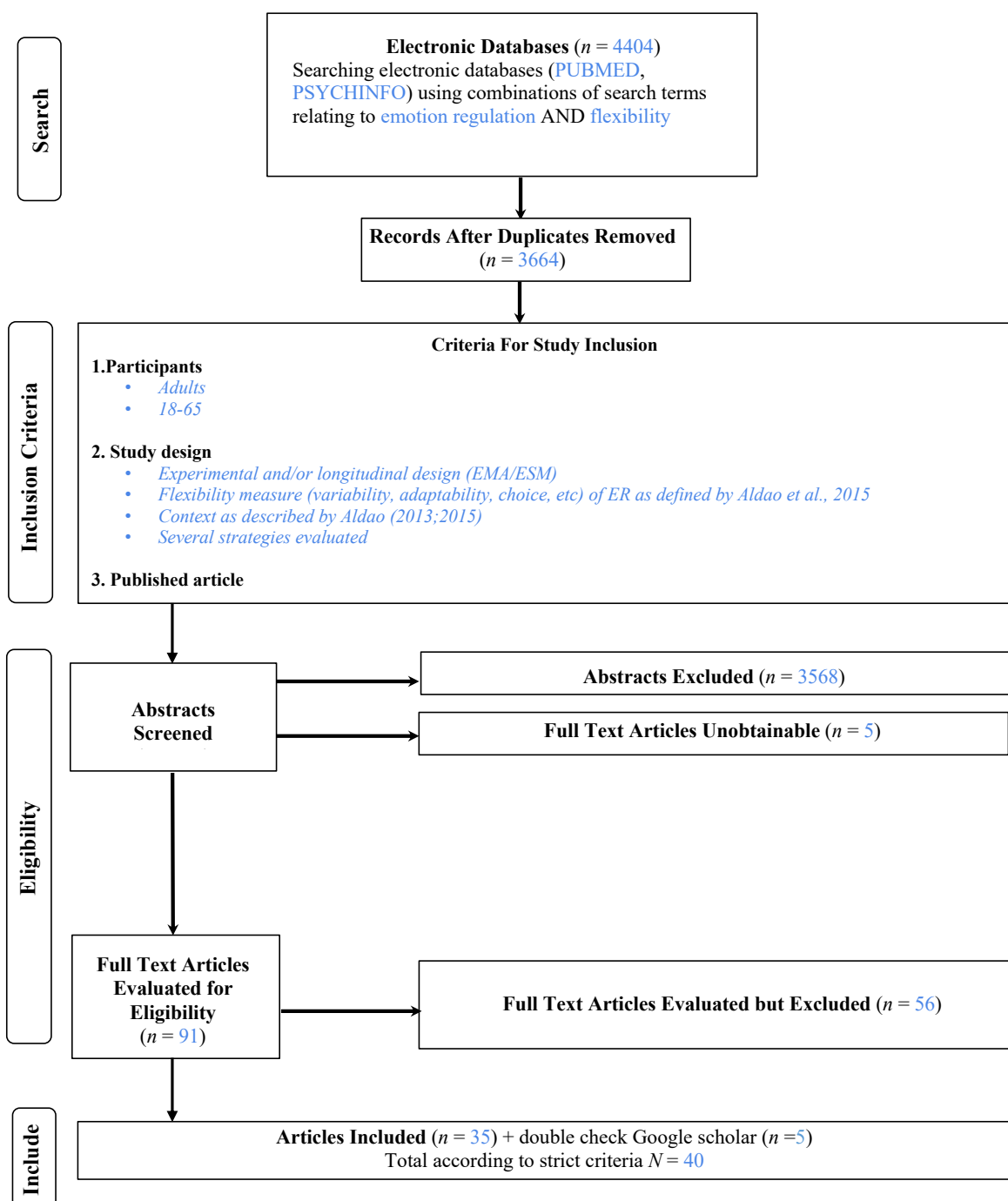
Studies were included in the systematic review if: (a) the sample was composed of adults from 18 to 89 years old, (b) the study measured ER flexibility (variability, choice, adaptability; Aldao et al., 2015; Sheppes et al., 2011), (c) context referred to Aldao et al.'s definition (2013, 2015) (the external context and/or reactions to stimuli and goals: emotions, emotional intensity, external context such as location, social context), (d) several ER strategies were explicitly evaluated, (e) the design was experimental and/or EMA/ESM type. The exclusion criteria were as follows: (a) unpublished articles and (b) studies that could not be obtained in English.

Screening and studies coding

The initial screening of studies implied the exclusion of those whose full texts were unobtainable (after search and authors contact). We created a coding sheet on Microsoft Excel, with information regarding the sample (type, sample size, clinical or non-clinical), measures used (questionnaires, ESM/EMA questions, etc), and design (experimental and/or ESM/EMA methodologies).

Table 1

PRISMA flow diagram of excluded and included studies in the systematic review ($N = 40$)



Results

After duplicates were removed, 3664 articles were evaluated based on their abstracts. In total, 3568 were excluded for meeting one or more exclusion criteria, and 5 full texts were unobtainable. Therefore, 91 full texts were evaluated, and 35 met the inclusion criteria. Additionally, a double-check on Google scholar added 5 articles to be included. Therefore, 40 articles met the inclusion criteria for this systematic review.

The result section will be divided into two sections: results concerning experimental measures of ER flexibility and results according to ESM/EMA studies. Tables of studies' description are provided in Supplementary material.

Experimental measures of ER flexibility

Several types of experimental tasks have been designed to assess ER flexibility, that is, have considered the role of context when assessing ER. This results section on experimental measures will be divided into three parts to investigate manipulations of context variables and measures of flexibility. Firstly, studies that use Sheppes's paradigm, secondly studies that use Bonanno's paradigm, and lastly studies that use other methodologies.

Sheppes's paradigm.

Sheppes et al. (2011) developed an experiment in which the context was manipulated by presenting participants with 30 emotional images varying in intensity (low vs high). Facing the images, they were asked to choose between two strategies (reappraisal and distraction) before applying them while watching the image again. Their results indicated that people tend to use more reappraisal facing low-intensity images and distraction when facing high-intensity images. Said otherwise, Sheppes et al. (2011) demonstrated that participants are flexible in their

ER by taking into consideration the context when selecting the best strategy to regulate their emotions (Sheppes et al., 2011).

This paradigm has been adapted to further understand which contextual features can modulate ER choice, such as past experience with the stimulus (Feldman & Freitas, 2021), type of goal (short term vs long term; Argyriou & Lee, 2020 - decrease vs increase the emotion; Millgram et al., 2019), or preceding stimulus intensity (Murphy & Young, 2018). Using the same paradigm, Sheppes et al. (2014) showed that when people have a short-term goal to regulate their emotions, they tend to use reappraisal when facing low-intensity stimuli and distraction when facing high-intensity stimuli. Interestingly, reappraisal is more chosen when dealing with a long-term goal (e.g., future exposure to the stimulus). Consistently, results indicate the participants will choose different strategies when the context and goals vary.

Likewise, this paradigm has been extended to assess an individual's choices when confronted with other ER strategies such as rumination and distraction (Millgram et al., 2019). Overall, results showed that rumination was more often chosen when the goal was to increase emotion, contrary to distraction, which was more frequently selected when the goal was to decrease emotion. Interestingly, this pattern was disrupted in clinical samples: even though their pattern of choice was similar to non-clinical samples, they selected less frequently the appropriate strategy, suggesting decreased flexibility in strategy selection in relation to goals.

Shafir et al. (2016) adapted the paradigm to explore whether more objective measures of emotional intensity predicted ER choice (stimuli such as images being based on subjective judgements). Thus, they developed a protocol using event-related potentials (and more precisely late positive potentials¹²) to assess whether neural markers of emotional intensity predicted ER choice in the same way that previous stimuli did (e.g., image intensity). This may

¹² The Late Positive Potential is a centro-parietal positive-going wave that becomes evident approximately 300 ms following stimulus onset, showing enhanced amplitudes as the processing of emotional-intensity increases (Hajcak et al., 2009; Shafir et al., 2016)

be a promising procedure, exploring new markers of ER flexibility beyond self-report. They found evidence for similar directionality in the neural intensity processing of emotional material and in the subjective emotional intensity category in predicting ER choice. Specifically, pre-choice neural information increased the probability of observing a distraction choice in subjective high intensity and reappraisal in subjective low intensity.

Finally, another study using Sheppes's paradigm proposed to compute a *regulatory choice flexibility index* (Levy-Gigi et al., 2016), by subtracting the proportion of distraction choice in the low-intensity pictures - reflecting maladaptive choice - from the proportion of distraction choice in the high-intensity pictures. Higher scores would be indicative of higher flexibility and thus the ability to choose an appropriate strategy in a specific context. This represents a first step to measure ER flexibility using an index, even though the researchers only analysed two ER strategies.

Many other studies employed Sheppes's experimental paradigm to explore the relationship between ER and mental health (Hannan & Orcutt, 2020; Hay et al., 2015; Martins et al., 2018; Orejuela-Dávila et al., 2019; Sauer et al., 2016; Scheibe et al., 2015; Young & Suri, 2020) and also to test whether Mindfulness-Based interventions influence ER choice (Alkoby et al., 2019).

In summary, the studies employing Sheppes et al.'s paradigm that manipulated a large set of contextual features were able to provide consistent evidence that participants' choices will vary significantly when their goals and/or emotional intensity of the current or preceding stimuli change. Therefore, they provide evidence in favour of ER flexibility as a major ability implicated in ER processes (Aldao et al., 2015), which can be disrupted in clinical samples (e.g., Hannan & Orcutt, 2020) and potentially enhanced by clinical interventions (e.g., mindfulness, Alkoby et al., 2019). Nevertheless, we can highlight some important limitations

such as the lack of ecological validity of the stimuli (i.e., images) as well as the manipulation of a few strategies.

Bonanno's paradigm.

Bonanno et al. developed the Expressive Flexibility task (EF) focusing on the ability to flexibly enhance or suppress emotional expression in congruence with situation demands (Bonanno et al., 2004; Gupta & Bonanno, 2011). In their experiment, they were interested in the ability to employ some specific strategies instead of focusing on choice or frequency of use. Participants underwent 3 conditions (enhancement, suppression of emotion expression, and control 'behave as normal' condition) while watching the pictures from IAPS. Participants were filmed through a one-way mirror and are either informed that someone in the next room would sometimes observe them on a video monitor to guess their emotions, or that the video would be turned off. The subjects' reactions were video-recorded and rated by observers blinded to the conditions. This paradigm offers a way to measure the ability to effectively use two opposing strategies, which they called *expressive flexibility*.

Zhu and Bonanno (2017) created another related task: the Affective Flexibility (AF) task to evaluate the association between the EF and the ability to flexibly modulate *subjective feelings*. In the AF task, participants were instructed to enhance or suppress their subjective feelings (instead of their expression in the EF task) while viewing negative pictures. In order to assess participants' ability to modulate their affective experiences, they employed both self-report and physiological measures (facial electromyography - EMG). Besides measuring *affective flexibility*, authors also sought to understand whether feedback would modulate participants' performances in both the AF and EF tasks, as the result of the monitoring process. Thus, participants received predetermined negative feedback on their performance and were then instructed to repeat each task. The authors compared regulatory performance across the

initial and later phases of the tasks to measure the effects of feedback on regulatory flexibility at the expressive and subjective levels. Overall, they found that the ability to effectively suppress and enhance subjective feelings and emotional expressions was comparable between the AF and EF tasks, although the impact of feedback led to inconsistent findings across the different types of response (e.g., EMG, self-reported affect), reflecting methodological difficulties in manipulating feedback.

To further assess the feedback step, Birk and Bonanno (2016) proposed a task to determine whether individuals were able to use internal feedback (i.e., corrugator activity, heart rate, subjective negative intensity)¹³ to change ER strategy (Study 1). Participants were presented images and instructed either to ‘decrease’ their emotional expression or ‘view’ (simply watching the stimuli) by using reappraisal. Participants could hear a tone and were said they could attempt to try distraction if they felt the reframing strategy was not working. Three scores of ‘Responsiveness to Internal Feedback’ (RIF) were calculated based on negative affect intensity, corrugator activity, and heart rate deceleration. The value reflected individual differences in the strength of emotional feedback associated with the decision to switch strategies. This procedure offers a way to calculate the extent to which participants’ switch between strategies is guided by internal feedback. Indeed, their findings suggested that internal feedback predicted the decision to switch from reappraisal to distraction.

Towards other operationalisations of context

Other tasks were developed to determine the flexibility of ER according to contextual determinants (e.g., feedback, instructions, intensity, controllability, social context, and goals). More specifically, the authors either proposed hypothetical scenarios (Goubet & Chrysikou,

¹³ Facial electromyography was used to measure the activity of the corrugator muscle (i.e., small muscle close to the eye), heart rate was measured with electrocardiography and electrodermal activity). These three indices have been associated with reactivity in response to emotional stimuli, and the use of ER strategies has been found modulating these indices (Dunn et al., 2009; Urry, 2010).

2019; Tang & Huang, 2019) and asked participants to imagine themselves in the situation or to recall autobiographical situations and detail how they regulated their emotions in the specific situations (Aldao & Nolen-Hoeksema, 2012; Dixon-Gordon et al., 2015). Other studies used film clips triggering different emotions (Greenaway et al., 2021; Oakley, 2020) or, still, asked participants to role play to code the number of strategies used (i.e., repertoire) (Hill, 2021). Overall, these studies found that individuals made different ER choices when the context changed and that this ability to switch strategies was associated with lower psychopathology (e.g., Aldao & Nolen-Hoeksema, 2012).

Some of these studies calculated a flexibility index. For example, Hill's coding of the number of strategies used leads to a repertoire score but without providing information on the adaptiveness of such strategies (2020). To capture strategy variability, Aldao and Nolen-Hoeksema (2012) computed the standard deviations (SD) of each strategy across all situations, with a higher SD reflecting more variability. As explained by the authors: 'the more variable implementation of adaptive strategies might be a function of a flexible assessment of contextual variation rather than of a haphazard process in which individuals unsystematically try to implement various adaptive strategies to 'see which one sticks' (Aldao & Nolen-Hoeksema, 2012, p.498). Although it represents a first step in measuring variability, one could argue that higher variability could reflect a systematic change of strategy highlighting a deficit in the implementation step.

Even though these indices are worth investigating, most of these studies only performed between-participant analyses to explore individual differences, preventing further information on the adaptation of strategies facing different contexts. Nonetheless, using these paradigms and indices could be useful while studying ER flexibility at a within-person level. For example, using scenarios allows for different context variations (e.g., life domain, intensity, controllability) and evaluates several spontaneous ER strategies. The variety of strategies

chosen by a given individual may reflect the first step of its flexibility capacity. Still, this procedure may lack ecological validity (Hughes & Huby, 2004), based on what individuals think they *would* do and not what they are doing in real life.

Biological processes of flexibility.

To explore the biological underpinnings of emotion modulation and their correspondence to subjective reports, some authors have been interested in studying possible markers of flexibility instead of directly targeting flexibility. For instance, Myruski et al. (2019) examined neural correlates of regulatory flexibility. More specifically, they assessed the Late Positive Potential (LPP), an event-related potential sensitive to modulation responses, considered here as a neurocognitive signature of regulatory flexibility, to examine its possible links with ER and emotional adjustment. Indeed, the LPP has been associated with the processing of emotional stimuli, and it has been shown that the magnitude of the LPP is greater when responding to an emotional stimulus (Cuthbert et al., 2000). Also, a reduction in the magnitude of LPP has been found after the implementation of ER strategies (Hajcak & Nieuwenhuis, 2006). Thus, LPP can be considered a promising marker of flexibility (both down and up-regulation) and, therefore, may operationalise ER as a temporally dynamic process and allow for capturing early attentional control process. In their study, the authors used the AF Task (Bonanno et al., 2004; Zhu & Bonanno, 2017). Flexibility was measured partly with the LPP difference scores reflecting the full range of regulatory change for pleasant and unpleasant stimuli. Their results showed that regulatory flexibility predicted greater self-reported use of coping flexibility¹⁴. Therefore, these neural measures seem promising as a marker of flexibility.

Summary of experimental studies

¹⁴ Coping flexibility refers here to ER flexibility; the ability to apply ER strategies in different contexts.

The results of these studies, using different paradigms, support the hypothesis that participants vary in the way they employ ER strategies according to the context (Sheppes et al., 2014) and that this ability might be an important marker of mental health (Aldao et al., 2015). Among the strengths of the experimental studies included is the measurement of the phenomena as they happen (contrary to self-report including most ESM studies) and the easy record of physiological data, which provide important information about the physical reactions when experiencing and regulating emotions (e.g., Bonanno et al., 2004; Levy-Gigi et al., 2016; Zhu & Bonanno, 2017). Lack of emotional awareness and other related issues might prevent individuals from correctly reporting whether the ER strategy they are employing really works and also correctly assessing their ability to effectively use one particular strategy. The experimental studies also enable us to understand how participants choose ER strategies when confronted with standardised situations, which allow us to limit the number of influential factors in the environment (e.g., targeting precisely one type of social situation). Finally, experimental designs provide further evidence on the steps of ER, for example by isolating one step in a controlled paradigm.

Experimental studies have mostly measured ER repertoire (e.g., Hill, 2021), for instance, by referring to the ability to use a specific strategy as in the Bonanno et al.'s paradigm (i.e., whether some strategies are preferred in some context) and by measuring the frequency or variability in terms of use of several ER strategies (i.e., the number of strategies they dispose of, ER repertoire) (Aldao & Nolen-Hoeksema, 2012).

Some studies calculated an index of flexibility as the ability to adjust to the context by considering, for instance, the degree of use of one strategy in two contexts (Levy-Gigi et al., 2016). However, these flexibility scores are limited by the fact that they do not take into consideration the notion of adaptability or steps/stages (e.g., feedback monitoring) of ER flexibility. Indeed, measuring variability and/or repertoire is not sufficient to investigate

flexibility (Aldao et al., 2015), as well as measuring the frequency of strategy use. Specifically, the frequency of use is not necessarily correlated with the ability to use such strategies efficiently. This implies that results indicate whether individuals are more or less flexible, although no inference about the adaptability of flexibility is provided.

If informative, these studies lack ecological validity by not looking at ‘real choices’ among all ER strategies available in the participants’ repertoire. Most often, participants are given either few or only two options which also limits the exploration of between-strategy variability (see however Goubet & Chrysikou, 2019), which prevents us from understanding how participants would really react in daily life situations, if the difficult situation was really happening. Moreover, stimuli used in these designs (images, film clips, scenarios) lack ecological validity, that is it does not refer to daily emotional stimuli that individuals can encounter. (See Supplementary material for a summary of experimental studies).

Daily measures of ER flexibility

Daily measures (ESM/EMA) have appeared as a solution to test the *strategy-situation-fit hypothesis* behind ER flexibility. It also allows better reports of available conscious information compared to classic questionnaires (Barrett & Barrett, 2001). Such paradigms seem to fill some gaps left by experimental methods in the ER field by enabling researchers to collect data in daily life. Therefore, in this second part of our systematic review, we will present ESM/EMA studies that are considered to measure ER flexibility.

Daily designs commonly request participants to complete measures of to which extent they felt specific emotions, employed specific ER strategies, and the context they found themselves, among other variables. As for experimental paradigms, the type and/or intensity of emotions appears to be a central contextual characteristic considered as possibly influencing strategy choice. A first set of studies applied an ESM protocol to examine the role of different

types of emotions or different intensities in ER strategies choice in daily life. More specifically, they explored whether emotions valence/intensity at T1 would predict ER choice at T2 (Blanke et al., 2021; O'Toole et al., 2017; Pavani et al., 2016; Southward et al., 2018, 2021). Their results evidenced that these contextual features impacted strategy choice (e.g., negative affect predicted rumination strategy; Pavani et al., 2016).

Other contextual features may also influence strategy choice. For example, Haines et al. (2016) and Finkelstein-Fox et al. (2019) evaluated whether cognitive reappraisal would be 'adaptative' in different contexts depending on the level of controllability over situations (i.e., 'To what extent were you in control of what's happened since the last survey?') by computing an index of covariation between change in reappraisal strategy use and perceived controllability. Their results show that reappraisal is only associated with well-being under uncontrollable contexts. As for another example, studies manipulated goal as context (English et al., 2017; Millgram et al., 2019) including whether the goal was to modify emotion (e.g., hedonic) or instrumental (e.g., to get work done) to assess the influence of different goals on strategy choice. Millgram et al. (Study 4, Millgram et al., 2019) found that participants varied their strategy of choice depending on the goal (decrease, increase, maintain emotion) set while facing a negative event: when the goal was to increase or maintain the negative emotion, participants favoured rumination whereas when the goal was to decrease they preferred distraction or expressive suppression.

Other studies considered the type of social situations as context. English et al. (2017) examined the role of goals and whether being alone or with others (e.g., close, non-close, and both close and non-close others) affects ER choice. More precisely, they tested whether event valence (i.e., positive vs negative events in a day) and the within-person interaction between valence and goal predicted strategy use. Likewise, Benson et al. (2019) explored age-related differences in how much individuals' use of two strategies (reappraisal and suppression) varied

across a wide range of different social contexts (e.g., close vs non-close social interaction context) and the extent to which ER strategy use covaried with relational and emotional features of social interactions (as defined as ER flexibility in their article). Individuals' ER strategy use across social situations was operationalised as the within-individual mean of all reports of each strategy for each time and in all social interactions. The variability was operationalised by the standard deviation of the same set of individual repeated measures. ER flexibility was examined with multilevel modelling. In both studies, important variations were found in situation-strategy fit. For instance, participants tend to use more emotional suppression when in public, and reappraisal and distraction when pursuing pro-hedonic goals (English et al., 2017). Interestingly, Benson et al. (2019) found that ER strategy use seems to vary more across situations than between individuals when analysing variance.

Overall, these results indicate that both social context and goals pursued influence strategy use in daily life. Thus, motivations underlying ER decision and selection seem crucial in adaptive ER and can be understood as key contextual variables to consider while studying ER flexibility.

The use of a variability index

Following Aldao et al.'s (2015) guidelines, some researchers have computed an index of flexibility, or at least an index of between- and within-strategy variability using time series to check for covariations across time (Benson et al., 2019; Blanke et al., 2020; Oakley, 2020; Wang et al., 2021). They relied on the assumption that context was naturally varying in these everyday life data, limiting the exploration of which specific aspect of context influences ER. Oakley (2020) asked participants to answer questions regarding the last 'interaction or event that was most stressful or upsetting today', such as how much they used six ER strategies and related goals. Oakley operationalised ER flexibility over time as a within-person variation in

the use of specific strategies. They estimated both the level of strategy use as well as the higher or lower levels of fluctuation in strategy use per person across days (person-specific residuals). This study design allows us to take into account time variation in the use of specific strategies. Their results showed that higher borderline symptoms were associated with decreased variability in specific strategy-use, i.e., reappraisal.

In sum, although the studies summarised here rely on Aldao et al.'s (2015) recommendations, they only assess whether individuals have a sufficient repertoire while missing the notion of flexibility (e.g., strategy-situation fit) and adaptability. Moreover, they do not cover the individual's ability to use these strategies, by focusing mainly on which strategies are chosen (and not whether they are appropriately implemented). Despite the limitations of the index, it was found that lower within-strategy variability was associated with higher levels of depression (Blanke et al., 2020) and borderline symptoms (Oakley, 2020), suggesting that it might be relevant to explore ER flexibility and mental health.

Measuring ER strategies on a daily basis

One important finding in our review is that all the ESM/EMA studies described above share one main limitation: the lack of ESM-items validation. ER strategies are often measured through one single item, preventing internal validation. The exception is the study by Medland et al. (2020). They validated a 12-item short version of the Regulation of Emotion System Survey (RESS), initially developed by De France and Hollenstein (2017). The initial 38-item RESS scale was designed to measure individual differences in the habitual ER by assessing six ER strategies, namely distraction, rumination, reappraisal, suppression, relaxation, and engagement. This scale has shown good reliability and validity, using a 6-factor structure in two Canadian undergraduate samples (Cronbach's alphas were between .83 and .98) (De France & Hollenstein, 2017). The short version used in EMA/ESM designs was composed of two items

for each of the six strategies. Participants had to rate their momentary affect and answer questions about the strongest negative emotion they felt in the last hour. They were particularly interested in three contextual indices: emotional intensity, controllability of the emotion and of the eliciting situation. Then, participants filled in the RESS scale. Using multilevel structural equation modelling, authors considered the nesting of measurement occasions within participants (i.e., considering a large number of measurement points for one participant), allowing for both within- and between-participant effects. Their findings provided evidence for the reliability and validity of the RESS for ESM/EMA designs, with acceptable within-person reliability ($\alpha = .69-.79$), such as between-person reliability ($\alpha = .98-.99$). Even if their validation study did not directly explore ER flexibility, this daily design implicitly does. Because ESM represents a promising methodology to assess ER flexibility, future studies need to address the validation of such scales.

Summary of ESM/EMA studies

Overall, these different studies highlight the relevance of daily designs, allowing us to consider ecological variations of context when trying to measure ER flexibility, defined as ‘covariation between ER strategies and changes of the environment’ (Aldao et al., 2015). Thus, they offer the possibility to capture ER dynamics on a daily basis and are promising to study flexibility with a more ecological perspective than in experimental designs. The temporality captured by daily designs may provide information on both the identification (whether the individual identified a need to regulate or not), selection (which strategy the individual chooses), and implementation (how effective is the applied strategy) stages of ER. Also, they can provide precious information on how individuals monitor their regulation (i.e., whether they stick to the strategy or switch to an alternative one). These methodologies are still in the early stages, and research should focus on developing standardised protocols to assess daily

behaviours. Nonetheless, as in many experimental studies, there is a limited number of ER strategies that participants can choose. Also, these protocols are still correlational and do not allow causal inferences (See Supplementary material for a summary table of ESM/EMA studies).

Discussion

The goal of this systematic review was to identify current measures of emotion regulation (ER) flexibility, as defined by Aldao et al. (2010), including experimental and ESM/EMA designs. Experimental studies have mostly employed procedures manipulating context, such as emotional intensity, to determine whether ER strategies vary across contexts. In turn, ESM/EMA studies captured context variations either by assessing them explicitly (e.g., English et al., 2017) or by considering time as a natural context variation (e.g., Blanke et al., 2020). Our review highlights the multiplicity of potential methods to assess ER flexibility, which might vary, among other reasons, because of the theory underlying the study. Still, no consensus has emerged so far to determine which methodology is best to assess ER flexibility. This discussion aims at providing some guidelines for future studies.

Toward a flexibility index?

The adoption of a between-participant design represents one of the most important limitations. It prevents us from better understanding individual differences in ER (e.g., Greenaway et al., 2021) and also from computing an index of flexibility, which is a way to present the individual's ability to respond in a flexible manner when choosing ER strategies according to the context. Within-person designs allow studying ER flexibility by catching strategy-use variations of one individual facing different contexts and also to understand in more detail how (the processes and stages) individuals achieve this flexibility.

A few studies have proposed an index of flexibility (Levy-Gigi et al., 2016) or other indexes that might represent some parts of flexibility (e.g., variability, expressive flexibility). However, there is no consensus on how to best compute it. Aldao et al. (2015) proposed two approaches to compute an index of ER flexibility. The first consists of regressing ER variability over changes in the context, using multilevel analyses. The second implicates calculating a standardised coefficient by cross-correlating the time series of ER variability with context variability. Moreover, Aldao et al. proposed an equation to compute ER adaptiveness, considering both ER variability, goals pursued, and the (short and long-term) efficacy of the strategy (see Aldao et al., 2015 for further details). These indexes could be used in both experimental and ESM studies, although, to our knowledge, they have only been used in the latter case and only using the ER variability index (Blanke et al., 2020; Oakley, 2020; Wang et al., 2021).

One important remaining question is whether we need an index of flexibility and whether it truly represents flexibility. Our answer is simple: it depends on the aspect of ER flexibility we want to assess. For instance, in the model proposed by Gross (2015), ER is a decision-making process characterised by several steps. Each decision individuals make throughout the process will define flexibility (i.e., choosing the appropriate strategy during the selection stage). It is important to understand which variables affect each step of the process to better understand ER flexibility (Sheppes, 2020). Likewise, in Bonanno's model, flexibility is conceptualised as a sequence of three steps. Although it is possible to calculate an index (e.g., expressive flexibility), it only represents one part of the flexibility concept. Thus, an index might not be necessary. Likewise, we might also be interested in which type of ER strategy one might choose as a function of specific aspects of contexts. In this case, we only would assess whether participants vary their strategies, and no index would be necessary either. Indeed, using standard deviation for between-strategy variability gives information on whether a participant

often varies in their strategy choice, but not on whether the chosen strategies are adapted to the contextual demand nor on which strategy is adapted in which context or whether the strategies are efficient (e.g., Wang et al., 2021). As highlighted by Bonanno et al. (Bonanno et al., 2004; Maccallum et al., 2021), much of the research on ER flexibility has focused either on the *frequency* individuals employ certain ER strategies or on the self-report ability to use it, even though people might not accurately report on their emotional life. Recent research has highlighted the importance of focusing on the ability to regulate one's emotions, indicating that both the ability to enhance and suppress emotional experience and expression is associated with better outcomes (Bonanno et al., 2004; Zhu & Bonanno, 2017).

Conversely, the strength of the index proposed by Aldao et al. (2015) is giving information on both within and between-strategy variability, strategy-situation fit, and goal pursued, for each individual in daily life. Thus, such an index can provide valuable information on the extent to which flexibility contributes to mental health. However, this index only provides information on whether the individual is or is not able to be flexible but does not allow researchers to understand the processes underlying (the how) flexibility. From a clinical point of view, there is more value in understanding how individuals function flexibly.

Indeed, between-strategy variability, for instance, might represent an indirect measure of individuals' ability to capture contextual demands, change ER strategies, as well as the individual's repertoire. These aspects have been emphasised in the models described by both Bonanno and Burton (2013) and Sheppes et al. (2011) and are suggested to be essential to understand ER flexibility. For instance, Bonanno and Burton (2013) propose that context sensitivity, repertoire, and feedback are essential steps to respond in a flexible way to contextual demands. Still, between-strategy variability is only an indirect measure. Thus, it is necessary to explore each of these steps/stages individually and which factors affect them (Sheppes, 2020), and to look at processes that are compelling components of ER flexibility even though barely

studies, such as the ability to monitor the efficacy of the ER strategy (Bonanno & Burton, 2013; Sheppes, 2020).

Variability in defining ER flexibility

Most of the studies operationalised flexibility as the ability to use one strategy above another when facing specific contexts (Levy-Gigi et al., 2016). Nevertheless, our review highlights the important diversity in the operationalisation of flexibility across studies. Moreover, most of them do not offer the whole picture of an individual's ability to change strategy in a context-dependent manner. Instead, it presumes that some strategies are more effective than others for all individuals without considering within-individual differences and other contextual features (e.g., suppressing an emotional expression in a professional context can be considered an efficient and adaptive ER). Or, by giving participants a limited set of choices, they prevent them from exploring which spontaneous ER strategy an individual engages in and the possibility to engage in more than one strategy simultaneously. Moreover, many ESM studies focus on variability in ER without considering the adaptiveness of this variability, i.e., whether the regulation was efficient or not. However, it should be considered as part of flexibility and associated with well-being (Aldao et al., 2015). Above the last part of Aldao's definition of flexibility (i.e., the adaptiveness of ER according to the meaningful goals pursued), the efficacy of the regulation appears to be decisive in the definition of ER flexibility.

Which method is the best?

One major advantage in using experimental and daily designs is that they offer a chance to draw, at least partially, causal inferences, whereas questionnaires mainly identify associations. On the one hand, experimental designs focus on specific steps of emotional processing (e.g., the implementation stage and the immediate consequences of strategies;

Demaree et al., 2006; Gross, 2015). On the other hand, daily designs allow a way of understanding the processing temporally and dynamically in daily life. Therefore, they are both needed to further understand ER flexibility.

Going back to Sheppes's model, each decision-making step should be considered to get the whole picture of ER flexibility, given its multi-stage nature (Sheppes, 2020). However, taking all steps into consideration and many aspects of context can be very challenging. Experimental measures are very useful in studying ER flexibility, especially because they allow exploring specific sub-processes of ER in a highly controlled design that cannot be offered with the ESM method. On the other side, ESM methods enable the modelling of the influence of both within- and between-individual factors on ER (Barrett & Barrett, 2001), and multiple points of measurement in more ecological contexts. Overall, it facilitates a more ecological measurement of psychological experiences. Currently, both ESM and experimental designs are well needed to measure ER flexibility, depending on whether the study aims at exploring specific ER processes (by isolating them) or at getting a temporal and dynamic overview of ER flexibility in a more ecological context.

What is context, after all?

Another important question raised in this review is the definition of context. When working on ER flexibility, a large number of contextual elements can influence ER choices. Conversely, taking all contextual variations into consideration seems almost impossible. It would require controlling all levels of context, i.e., personal features (e.g., demographics, personality, appraisal), situational features (e.g., situational goals, social context, activity), type of emotion and its intensity, and cultural features (English et al., 2017; Greenaway et al., 2018; Millgram et al., 2019; Pavani et al., 2016; Sheppes et al., 2011). Others propose to take time as the source of natural contextual variations (e.g., Blanke et al., 2020).

ER has been defined as a decisional process in which the individuals assess the cost-benefits of implementing a strategy to choose one that will optimise their changes to reach their goal in the specific context (Bonanno & Burton, 2013; Sheppes, 2020). As suggested by Tamir (2016), we argue that a possible initial alternative to this challenge is the study of the individual's goals and motives related to the ER. Indeed, individuals choose different strategies when facing different contexts (e.g., Sheppes et al., 2011). Also, success in ER may depend on the adaptiveness of strategies to match current goals, whether hedonic or instrumental ones (Tamir et al., 2020). Therefore, different contexts will generate different goals, and different goals will generate different ER strategies. In this perspective, focusing on individuals' goals as contextual features may be a promising and feasible approach to studying contextual influence in ER flexibility. Moreover, in the field of psychopathology, it is also important to consider that adaptiveness may also depend on the flexibility of choosing one's goals. If individuals' goals are constantly to reduce negative emotions, a pattern of rigid ER choices will probably emerge. For that reason, we should consider to which extent the goal is congruent with one's individual values (Hayes et al., 2006; Kashdan & Rottenberg, 2010) in line with psychological flexibility, defined as the ability to handle distress, take actions to manage it in a way that fits situational demands, and facilitating the pursuit of personal goals and values (Cherry et al., 2021).

Still, we also believe that it should be only a first step considering that many strategies (e.g., talking to a friend, suppressing emotion, distraction) might be used to reach the same goals (e.g., reduced negative emotions) and that the strategy might be chosen according to the resources available in the situation (e.g., having someone to call).

In summary, this systematic review leads us to conclude that investigating which strategy individuals favour in different contexts/goals (whether it is in experimental or in daily

designs) is most essential to increase knowledge on how strategy choice varies by context, and thus understand how people are functioning flexibly.

Recommendations

Based on the studies reviewed here and on the points highlighted before, we outline a few recommendations for future studies.

1. Adopting within-analyses in order to further understand ER flexibility.
2. Specifically assess the context and the level of adaptiveness associated with the use of an ER strategy when assessing ER flexibility. Otherwise, specifying whether the study aims at measuring ER variability or flexibility.
3. Specifying the underlying theory when studying ER flexibility to justify the hypotheses.
4. Being explicit about the operationalisation of the context (focusing on the individuals' goals is a promising approach).
5. When possible, using both experimental and experience sampling methods.
6. Considering the participants' repertoire by giving, as much as possible, the opportunity to choose among several ER strategies options.
7. More than the variability, considering the individuals' ability to monitor and change strategy if needed, and, more importantly, the ability to apply such strategies effectively.

Conclusion

Currently, there is a strong need for instruments and procedures that assess ER flexibility in a valid and reliable way (Berking & Wupperman, 2012). Some of the studies presented here are promising regarding context variations, but only a few of them provide information at a

within-individual level. Evaluating ER in relation to changes of the context, i.e., ER flexibility, will help validate if this ability can be considered central in the ER field and more broadly will explore its importance in clinical psychology. This could impact the development of new clinical interventions, specifically targeting ER flexibility instead of ER strategies. Also, longitudinal or intervention designs are lacking in the field to test the predictive role of ER flexibility in mental health.

To conclude, both experimental and daily designs are needed to better understand ER processes. Experimental designs will increase knowledge of specific steps of ER and possible causal relationships, while daily designs will increase knowledge of within-individual patterns of ER in ecological contexts.

6. Study 4: Experimental study on emotion regulation choice

The systematic review guided us to argue that both experimental and daily designs are useful to measure ER flexibility, depending on what we precisely want to measure. In this perspective, we conducted an experimental study to assess ER strategy choice facing different contexts (i.e., emotional intensities).

Emotion regulation choice: A Replication and Extension study¹⁵.

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Preregistration, data, material, and supplementary material: <https://osf.io/s6kmr/>

¹⁵ This version of the article was adapted to avoid repetitions with the Chapter. Also, parts non relevant for the present thesis were removed, and thesis-related objectives were added.

Abstract

Evidence shows that participants choose to disengage during emotion regulation (ER) when facing high intensity stimuli, whereas engage when the intensity is low. No study explored ER choice when participants have more than two strategies to regulate their emotions. This study aimed to replicate and extend the results of Sheppes et al. (2011). In total, 128 non-clinical participants completed two experimental tasks (a replication task and an extension task), choosing an ER strategy in two conditions. Participants favoured disengagement strategies when the emotional intensity was high and engagement strategies when the intensity was low. Exploratory analyses suggested an influence of ER skills on ER choice in strategies. These results expand our understanding on ER choices and provide knowledge on flexibility in ER.

Keywords: Emotion regulation, emotion regulation choice, emotion regulation flexibility.

Introduction

Sheppes et al. (2011) designed an experiment to explore whether participants would choose different ER strategies (i.e., cognitive reappraisal vs distraction) depending on the context, here, the intensity of the stimuli (i.e., high- and low-intensity negative images). Overall, in high emotional intensity contexts, participants chose disengagement strategies (e.g., distraction), while engagement strategies (e.g., cognitive reappraisal) were favoured in low emotional intensity contexts (Sheppes et al., 2014). The authors argue that strategies intervene at different levels of emotional information processing (Sheppes et al., 2011). More precisely, distraction would implicate an initial mechanism of information selection at an early attentional level, resulting in disengagement from emotional information before it is processed in working memory. Reappraisal, a later mechanism, would consist of an attentional engagement in processing emotional information at a semantic level. They argue that individuals regulate emotions by flexibly switching strategies depending on context (Gross, 2015; Sheppes et al., 2011). More precisely, Sheppes and Gross (Sheppes, 2020; Sheppes & Gross, 2012; Sheppes et al., 2011) conceptualise ER as a set of decision-making processes that take place at different stages of ER: identification (initially deciding whether to regulate or not), strategy selection (which strategy is selected) and implementation (how the strategy is implemented) (Sheppes, 2020).

Despite the strengths of this study, including the fact that it was replicated several times (e.g., Argyriou & Lee, 2020; Hay et al., 2015; Young et al., 2019), one of its major limitations is its two-alternative forced choice paradigm. Thus, little is known about whether participants will make the same choices (reappraisal vs distraction) when they are given more options or when they can spontaneously choose them, and whether other strategies are chosen according to their disengagement vs engagement classification. This forced-choice paradigm prevents participants from selecting and implementing different or multiple strategies (Aldao & Nolen-

Hoeksema, 2012), which limits our understanding of an individual's ability to be flexible in ER. Therefore, the first aim of this study is to replicate Sheppes et al.'s results in a French sample while extending them by exploring what strategies individuals will choose when they are given different ER strategies options.

Objectives

- (1) The first goal of this study was to replicate Sheppes's results regarding adaptive choices when changing context (i.e., high- vs low-intensity images) in a French sample (Replication task).
- (2) Secondly, the purpose of this study was to extend these results by exploring other strategies. More precisely, we will explore whether engagement strategies are more chosen in the low condition and disengagement strategies in the high condition (Extension task). Likewise, we want to explore what type of ER strategy participants use most often under low and high-intensity emotion when they are given more options in terms of ER strategies.
- (3) The third goal of this study was to explore the role of ER skills in ER choice in the two tasks.

Hypotheses

- (1) From a replication perspective, we hypothesised that reappraisal would be preferred in the low condition, and distraction in the high condition.
- (2) Also, we expected that engagement strategies (i.e., reappraisal, rumination, acceptance) would be preferred in the low condition, and disengagement strategies (i.e., distraction, behavioural avoidance, relaxation) in the high condition. From an

exploratory perspective, we wanted to explore which specific strategy was chosen when various options were given.

Method

Participants

Participants were French women and men recruited from the general population. Our sample was recruited through online social media, university mailing lists and acquaintances of the authors with a snowball procedure. Inclusion criteria consisted of being between 18 and 65 years old and fluent in French. Participants received 10€ compensation for participating in the study or course credits if they were students. Exclusion criteria consisted of having vision or motor difficulties that could make the task impossible (i.e., watching images and using a computer), previous participation in another study on emotion regulation, and being a student in psychology at the Master's level. Considering that most of our initial sample was composed of psychology students, we decided, later on in the implementation of the study, to no longer include students in psychology in general.

In total, 128 participants were recruited and completed the study. The study was carried out according to the code of ethics of the World Medical Association (Declaration of Helsinki). Moreover, data collection was carried out to ensure that participants' identities remained anonymous and the hypotheses were preregistered <https://osf.io/s6kmr/>. All material and the Rstudio script can be found on the same link.

Measures

Step 1: Measures used during the experimental tasks

Emotion regulation strategies. Seven strategies were proposed for the Extension task: reappraisal, distraction, behavioural avoidance, relaxation, suppression of emotional

expression, acceptance and rumination. Participants could also choose any other strategy from their repertoire by selecting the option “other”. For the Replication task, as in the previous study by Sheppes et al. (2011), only two strategies were proposed to the participants: reappraisal and distraction.

Manipulation checks. We included three manipulation checks. First, we included (1) a measure of emotional intensity using the Self-Assessment Manikin (SAM; Bradley & Lang, 1994). The SAM evaluates both the emotion’s arousal dimension (i.e., the extent to which the image elicits excitement or appeasement from 0 to 9) and valence (i.e., the extent to which the image elicits pleasantness or unpleasantness from 0 to 9). For the Replication task only, we also evaluated (2) participants’ subjective perception of their ability to employ the chosen strategy from 1 Not at all to 7 perfectly (considering reappraisal and distraction separately). Finally, they were also requested to report the percentage of time (3) they spent applying each strategy and (4) not looking at the images displayed on the screen. No additional manipulation checks were added to the Extension task.

Step 2: Questionnaires completed at the end of the study

Sociodemographic questions. Age, sex, status (student or not, which studies), highest level of education, self-report psychiatry diagnosis and treatment.

Participants also completed the **Emotion Regulation Skills Questionnaire** (Berking & Znoj, 2008). This questionnaire comprises 27 items aiming at measuring ER skills as defined in the ACE model (Berking & Whitley, 2014) through nine factors: attention, sensations, clarity, understanding, modification, acceptance, tolerance, confrontation, and self-support. Each subscale is composed of three items, assessed with a Likert scale ranging from 0 ‘Not at

all' to 4 'Almost always'. Internal consistency of the ERSQ subscales ranged from .67 to .96 in the original version.

Participants also completed the **Community Assessment of Psychic Experience 42** (CAPE-42, Stefanis et al., 2002) to measure psychotic experiences, which was analysed in the published article.

Material

Images were all extracted from the IAPS (International Affective Picture System; Lang et al., 2005). Images were classified as High- or Low-intensity depending on their scores on valence and arousal (Sheppes et al., 2011).

The images used in the Replication task were the same as those used in the original study by Sheppes et al., 2011. Moreover, these images were pretested in a French sample ($n = 26$), previously to this study, confirming lower valence ($t(21) = -16.53, p < .001$) and higher arousal ($t(21) = 7.10, p < .001$) for high-intensity images compared to low-intensity images¹⁶. Likewise, for the Extension task, new pictures were extracted from the IAPS and pre-tested in a French sample ($n = 41$). Results supported lower valence ($t(39) = -12.3, p < .001$) and higher arousal of high-intensity images ($t(39) = 10.9, p < .001$), confirming the categorization of high vs low-intensity images¹⁷. We also compared images from the Replication task and the Extension task in order to ensure they were equivalent. High-intensity images were not statistically different in valence or arousal ($p = .09, p = .08$), nor were the low-intensity images ($p = .24, p = .79$). The differences between the images were assessed using the Self-Assessment Manikin (Bradley & Lang, 1994), measuring both valence and arousal.

¹⁶ The mean arousal and valence for low-intensity images were respectively of 3.73 and 7.61. The mean arousal and valence for high-intensity images were respectively of 5.77 and 5.46 (Replication task).

¹⁷ The mean arousal and valence for low-intensity images were respectively of 4.95 and 3.05. The mean arousal and valence for high-intensity images were respectively of 6.08 and 2.01 (Extension task).

The ID number of each image used in this study is available in Supplementary material and the data related to the pre-tests can be found in OSF.

Procedure

Participants were recruited through online social media, university mailing lists and acquaintances of the authors with a snowball procedure. They were invited to scan a QR code or click on a web link to an online platform (i.e., Evento) to choose their time slot. Upon arrival in the lab, participants completed the whole study on a computer. The study was set up on Qualtrics. Prior to the experiment, participants were informed about the study (i.e., the objective, the nature of the measures being collected, the nature of the constraints associated with the study, the foreseeable risks and the expected benefits of the research, their rights in the context of research involving the human being), and created an anonymous code. Participants were also explicitly informed (before and during the study) that they would be invited to watch a few images that could be a source of discomfort. They were invited not to enrol in the study or stop any time they wanted if they judged the images could make them feel uncomfortable (see OSF page for more detailed information). After reading all the information regarding the study, participants signed the consent form.

The Extension task was always completed before the Replication task in order to avoid the effect of the training phase from the latter task into the former. The procedure of the two tasks is described below.

(a) Extension task

Before the Extension task, a list with names and definitions of the 7 ER strategies was given to participants (see Supplementary material). A training phase during which the experimenter was present (to answer possible questions and ensure the participants understood

the proposed strategies) comprised 8 images (4 low- and 4 high-intensity). Participants watched the image for the first time (500ms) and then had to choose between 7 ER strategies (a list with the names of the strategies was provided), including the option “other”. Subsequently, participants had to apply the chosen strategy when presented with the image for the second time (5000ms). As in the original Sheppes et al. (2011) study, the Extension task was composed of two conditions: 15 high vs 15 low-intensity randomly presented images that individuals were asked to watch (see Figure 1).

After the Extension task, participants were asked to fill out the manipulation checks described above and to answer simple calculations to allow a return to a basal level in terms of emotional intensity before proceeding to the Replication task.

(b) Replication task

The Replication task used the same procedure described above, but this time only two strategies were proposed (i.e., reappraisal and distraction), as described in Sheppes’s procedure (2011) (see Figure 1). In order to teach individuals to apply each strategy, participants took part in a familiarisation phase during which they were asked to watch 4 images (2 low- and 2 high-intensity) (500ms), and to apply a given strategy while watching the image again (5000ms). Participants were given specific instructions on how to use these strategies: *‘Each image will appear once very quickly, and will be followed by an instruction, which you will apply when the image appears again. You will be instructed to either distract yourself by occupying your mind with things unrelated to the image, or to reappraise, thinking about the image in a way that reduces its negative interpretation’*. Subsequently, more specific instructions detailing how to apply each strategy was provided (see OSF for more details on the methodology).

The familiarisation phase was followed by the training phase, in which participants had to choose the strategy to apply while watching 8 images (4 low- and 4 high-intensity). During

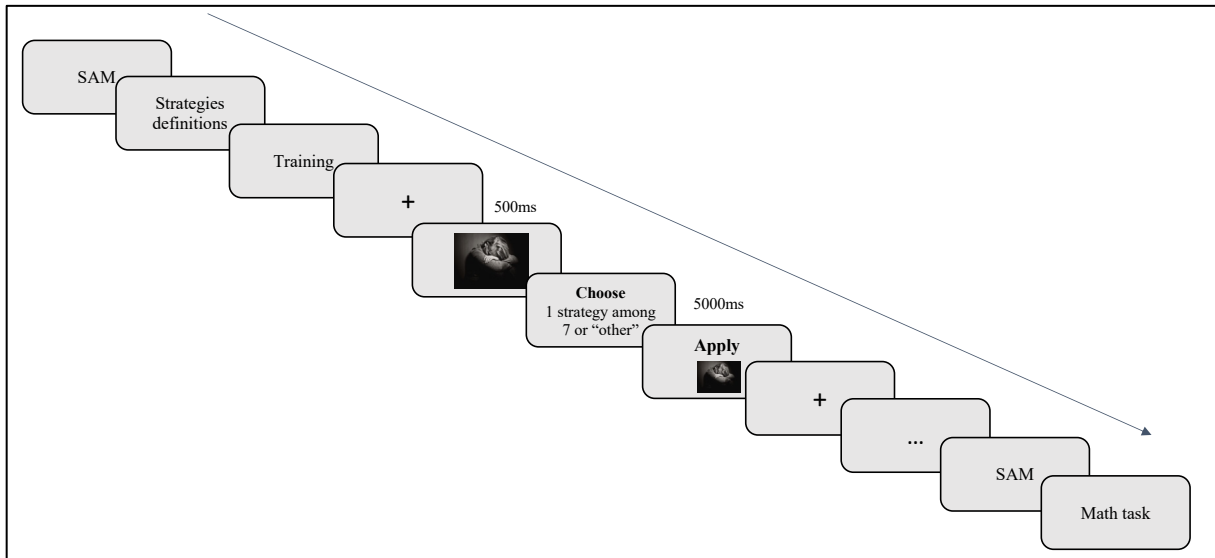
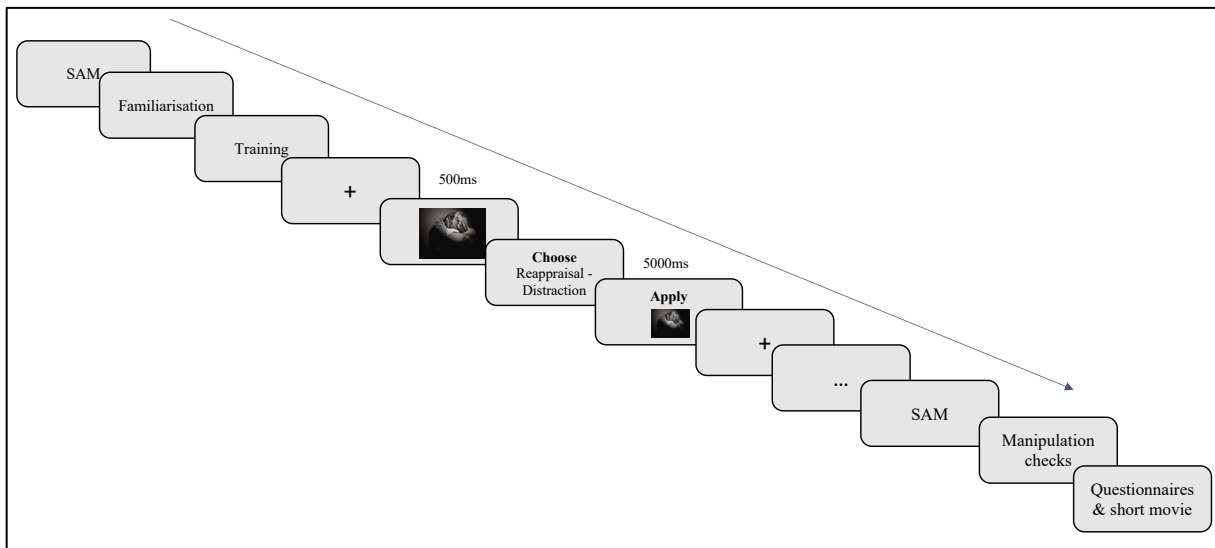
both the familiarisation and training phases the experiment stayed in the room to answer possible questions. The main task was then composed of 15 low- and 15 high-intensity randomly presented images.

After the Replication task, participants were asked to fill out the manipulation checks described below and the different questionnaires (see *Measures*). Before leaving the laboratory, they were presented with a happy short movie (i.e., Baby Girl Laughing Hysterically at Dog Eating Popcorn, available on YouTube) to ensure all participants decreased emotional intensity (see Figure 1).

(c) Manipulation checks

Participants completed the SAM before and after each task, resulting in four measures of emotional valence and arousal. Thus, the participants completed the between task measures twice, before and after the math task. The math task was added between the two experimental tasks to bring emotions back to their baseline levels.

After the Replication task, they were asked to complete the additional manipulation checks to verify (1) the perceived difficulty of task when applying reappraisal vs distraction, (2) the overall time perception spent using one strategy, and (3) the appropriate watch of the images.

Figure 1*Trial procedures for both tasks***(a) Extension task****(b) Replication task**

Statistical analyses

All analyses were performed using R and Rstudio free software version 2021.09 (RStudio Team, 2022).

The hypotheses were tested by fitting logistic regression models using Generalised Estimating Equations (GEE) method for parameter estimation (Liang & Zeger, 1986) (*geeglm* function from the *geepack* package) (Højsgaard et al., 2006). This method allows the modelling of binary outcomes (i.e., reappraisal vs distraction in the Replication task; engagement vs disengagement strategies in the Extension task), while considering repeated observations within each participant (15 trials of each condition) (*GEE*; Ballinger, 2004). In GEE, a working correlation matrix is defined, and regression estimates are generated as if the observations were independent. Because of the longitudinal design (trials), an autoregressive working matrix was used. The sample size of 128 met the minimum assumption of 50 clusters (McNeish & Stapleton, 2016). GEE analyses were conducted predicting strategy selection (0 = reappraisal vs 1 = distraction in the Replication task; 0 = engagement [reappraisal, acceptance, rumination] vs 1 = disengagement strategies [distraction, behavioural avoidance, relaxation, expressive suppression] in the Extension task), and included predictor was condition (low intensity coded 0 vs high intensity coded 1). In exploratory analyses, the condition was coded as low = -0.5 vs high = +0.5 to test the general influence of ER skills in both conditions (ERSQ-total score, centred using the *scale* function), as well as the interaction Condition*ER skills. To facilitate interpretation, coefficients on logit scale from the analyses were transformed into odds ratio (using the *exp* function, built-in R function), and odds were converted to probabilities by dividing the odds by one plus the odds. Also in exploratory analysis, MANOVA was performed using the *lm* function from the *car* package (Fox et al., 2007). Correlational analyses were performed using the function *cor* from the *stats* package (Scott, 1990). Finally, analyses related to manipulation checks were performed using Wilcoxon tests (using the function *wilcox.test*,

built-in R function). To clarify the presentation of results, we will first present the findings related to the Replication task before those of the Extension task.

Results

The descriptive characteristics of the sample are presented in Table 1.

Manipulation checks were investigated using Wilcoxon tests, which revealed a significant difference between emotional intensity after the Extension task and before the Replication task (isolating the math task) ($V = 2500.5, p < .001$). Emotional intensity was significantly higher after the Extension task than before the Replication task, suggesting that the math break did serve as a distractor by decreasing emotional intensity before the Replication task. However, no significant difference was found for emotional intensity measures after both tasks ($V = 2004.5, p = .42$), which indicates that they induced a similar overall level of emotional intensity.

Moreover, participants reported being more successful in applying reappraisal ($M = 4.98, SD = 1.32$) compared to distraction ($M = 4.18, SD = 1.57$) ($V = 1611.5, p < .001$). Additionally, participants spent significantly more time on average using reappraisal ($M = 58.65\%, SD = 23.79\%$) compared to distraction ($M = 46.31\%, SD = 24.80\%$) ($V = 2070.5, p < .001$). Finally, participants reported, on average, spending 15.74% of the time not looking at the images ($SD = 18.54\%$).

Table 1*Descriptive Data*

Variable	n = 128
Age (years ± SD)	26.9 ± 11.7
Highest level of education (n [%])	
First cycle of secondary education	2 [1.6]
Second cycle of secondary education	65 [50.8]
Bachelor's degree	35 [27.3]
Master's degree	22 [17.2]
Doctoral degree	4 [3.1]
Gender (n [%])	
Female	105 [82.0]
Male	21 [16.4]
Non-binary/transgender	2 [1.6]
Questionnaire M ± SD	
ERSQ – Total scale	68.1 ± 13

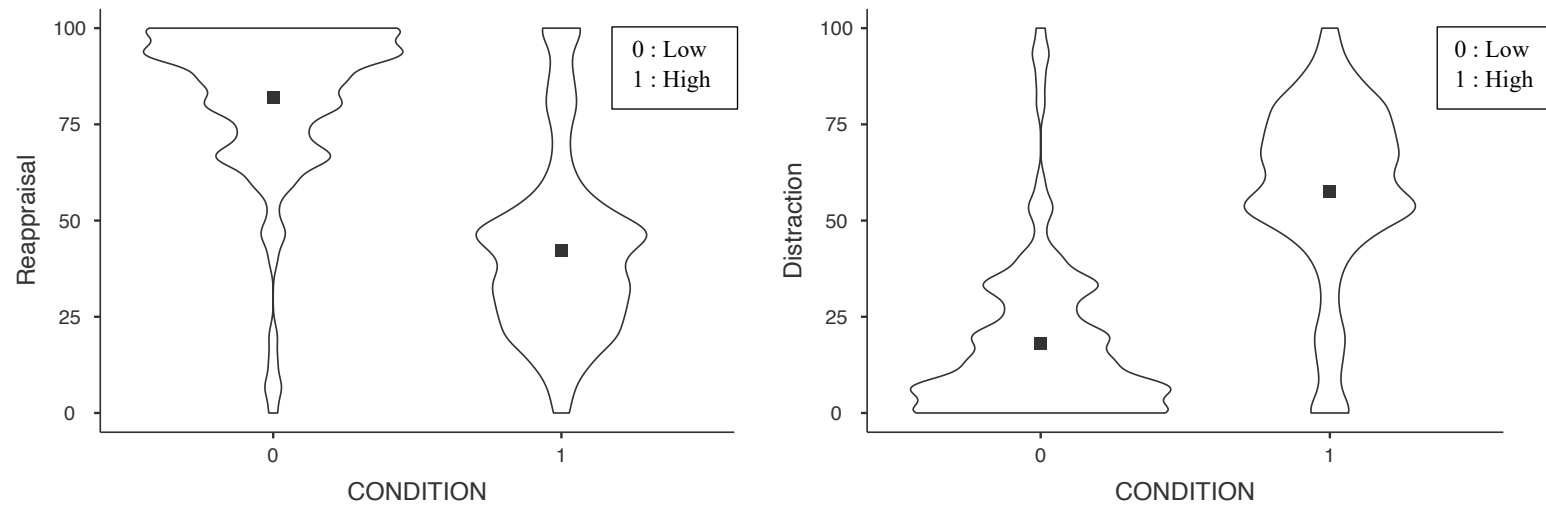
Note. M: mean; SD: Standard Deviation; ERSQ: Emotion Regulation Skills Questionnaire.

Sheppes's Replication task.

For comparison with previous studies, the percentage of each strategy used was calculated (see Figure 2).

Figure 2

Violin plots for percentage of use of each strategy (Replication task)



Note. ■ : Mean percentage.

As hypothesized (H1), the effect of condition (low vs high) was significant $\chi^2(1) = 150$, $p < .001$, QIC = 4435.68). The odds of choosing distraction in the high condition were 6.24 times higher than those of choosing distraction in the low condition ($\beta = 1.83$, $p < .001$), which means that the probability to choose distraction in the high condition was of 86%. In the low condition, the odds of choosing distraction were of 0.22 ($\beta = -1.54$, $p < .001$), which means that the probability to choose distraction in the low condition was of 18%. This indicates that participants chose more distraction in the high condition, and reappraisal in the low condition (Table 2).

Table 2

GEE logistic regression analyses predicting the probability of choosing distraction in the Replication task

Model	β	SE	Exp(β)	Exp(β)	Wald	p-value	QIC
				%2.5 – 97.5			
Intercept	-1.54	0.12	0.22	0.17– 0.27	153.6	< .001	4435.68
Condition	1.83	0.15	6.24	4.66 – 8.37	150.00	< .001	

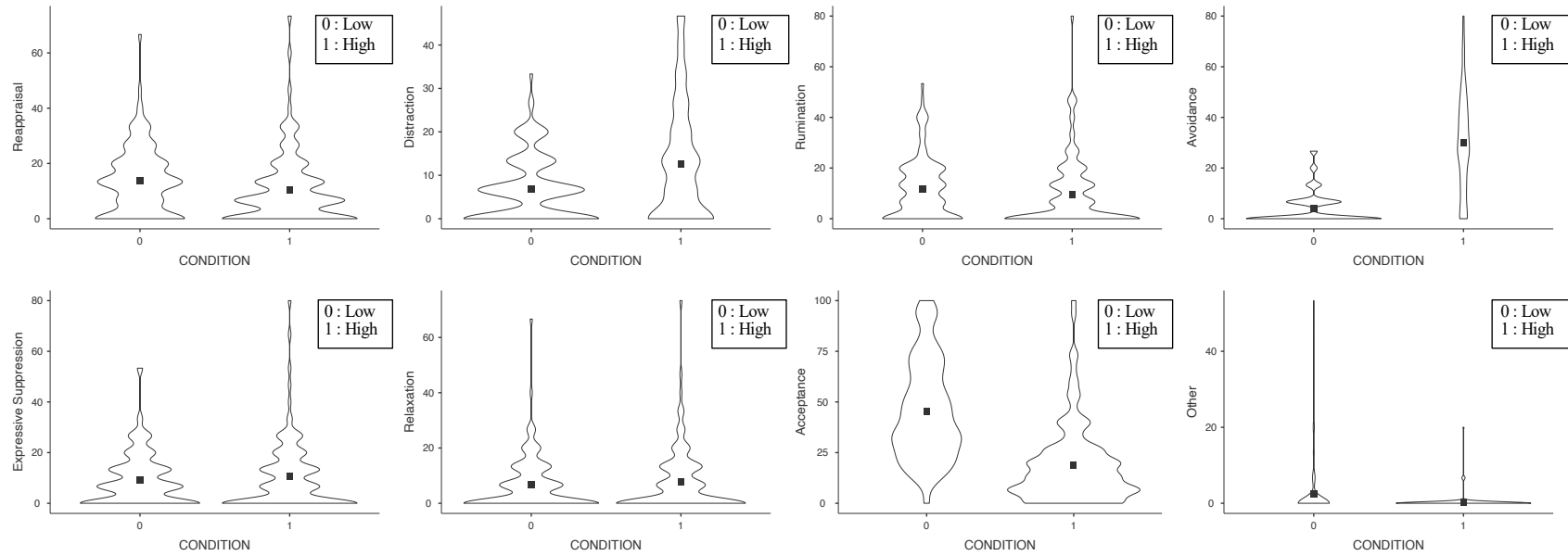
Note. β = coefficient on the logit scale; SE = Standard error; QIC = Quasi-Likelihood Information Criterion.

Extension task.

To extend previous studies, the percentage of each strategy used was calculated (see Figure 3). Importantly, the strategies were grouped into two categories: disengagement (i.e., distraction, behavioural avoidance, relaxation, expressive suppression) and engagement strategies (reappraisal, acceptance, rumination) following Sheppes's model (Sheppes et al., 2011, 2014).

Figure 3

Violin plots for percentage of use of each strategy (Extension task)



Note. ■: Mean percentage.

The effect of the condition was investigated in the Extension task to explore its impact on various strategies (H2). As hypothesized, the effect of emotional intensity (low vs high) was significant ($\chi^2(1) = 140, p < .001, QIC = 4770.49$). The odds of choosing disengagement strategies in the high condition were 4.05 times higher than those of choosing disengagement strategies in the low condition ($\beta = 1.40, p < .001$), which means that the probability to choose disengagement strategies in the high condition was of 80%. In the low condition, the odds of choosing disengagement strategies were of 0.38 ($\beta = -0.98, p < .001$), which means that the probability to choose disengagement strategies in the low condition was of 28%. This indicates that participants choose more disengagement strategies in the high condition, and more engagement strategies in the low condition (Table 3).

Table 3

GEE logistic regression analyses predicting the probability of choosing disengagement strategies in the Extension task

Model	β	SE	Exp(β)	Exp(β) %2.5 – 97.5	Wald	p-value	QIC
Intercept	-0.98	0.08	0.38	0.32 – 0.44	145	< .001	4770.49
Condition	1.40	0.12	4.05	3.21 – 5.10	140	< .001	

Note. β = coefficient on the logit scale; SE = Standard error; QIC = Quasi-Likelihood Information Criterion.

Exploratory Analyses

In the Replication task, the exploratory analyses revealed a significant effect of the ERSQ, suggesting that higher ER skills were associated with a decreased distraction choice in both conditions. Moreover, it is of note that the interaction term was tendential, suggesting that the effect of the condition could be dependent on the level of ER skills (see Supplementary material). Exploratory analyses also revealed that only the Acceptance and Tolerance

dimensions of the ERSQ predicted decreased distraction choice (respectively, $\beta = -0.11, p < .01$ and $\beta = -0.09, p < .001$).

In the Extension task, the effect of ER skills on ER choice was tendential ($p = .07$), possibly indicating that greater ER skills could be associated with fewer disengagement strategies in both conditions (Supplementary material). This finding is congruent with the negative correlation found between ER skills and suppression strategy (Supplementary material). Exploratory analyses also revealed that the Awareness, Acceptance and Tolerance dimensions of the ERSQ predicted decreased disengagement strategies (respectively, $\beta = -0.06, p < .03, \beta = -0.13, p < .01, \beta = -0.09, p < .01$). However, all the interaction terms between Condition and ER skills were not significant, indicating the ER skills seem to influence ER choice in favour of more engagement strategies, without being impacted by intensity of the stimulus.

Discussion

Emotion regulation choices are currently considered to be context-dependent (Bonanno & Burton, 2013). Sheppes's paradigm was designed to investigate strategy choice when individuals are confronted with context variation (here, emotional intensity). The main goal of this study was to replicate this paradigm and to extend it in a task displaying a broader list of ER strategy options. We additionally explored the influence of ER skills in the choice of strategies in both tasks.

Sheppes's paradigm replication and extension

The first aim of the present study was to replicate Sheppes's results regarding ER choices when changing context in a French sample. In line with previous findings (Sheppes & Levin, 2013; Sheppes et al., 2011, 2014), our results indicate that participants most often choose

distraction in high emotional conditions and reappraisal in low emotional conditions. It has been suggested that this ability to choose and switch strategy according to contextual change refers to ER flexibility (Kashdan & Rottenberg, 2010), illustrated in this paradigm by a preference for reappraisal in low-intensity and distraction in high-intensity contexts. Therefore, our results support the importance of studying how individuals' ER choice varies depending on the context (i.e., emotional intensity) by favouring disengagement strategies in high-intensity contexts and engagement strategies in low-intensity contexts (Gross, 2015; Sheppes et al., 2011). However, one important limitation of the traditional paradigm proposed by Sheppes et al. (2011) relies on the forced-choice experimental task used and, thus, on the manipulation of only two strategies (i.e., distraction and reappraisal). As shown elsewhere (Aldao & Nolen-Hoeksema, 2012), individuals often rely on many strategies when regulating their emotions. As such, the two forced-choice between distraction and reappraisal might not represent participants' real choices when facing stressful situations.

Therefore, the second goal of the present study was to extend the number of strategies proposed in Sheppes's paradigm and, more specifically, explore what strategies individuals would choose when given a wider range of choices in terms of ER strategies (i.e., reappraisal, distraction, avoidance behaviour, relaxation, suppression of emotional expression, rumination, acceptance) in two different contexts (high vs low emotional intensity; Extension task). As mentioned before, based on their model, Sheppes et al. proposed categorising ER strategies as either disengagement or engagement strategies depending on the level of emotional information processed (Sheppes et al., 2011, 2014). Notably, this dichotomisation was first proposed in the coping literature (e.g., Carver & Scheier, 1982), depicting engagement-oriented and disengagement-oriented coping strategies. The former refers to strategies that focus on dealing with the stressor or emotion, whereas the latter corresponds to strategies that focus on avoiding it. These categories have also been recently adopted in the development of a new ER

questionnaire, categorising strategies such as confronting unpleasant situations or resolving conflicts as engagement ones and strategies such as cognitive distraction and expressive suppression as disengagement ones (Olderbak et al., 2022). Based on this dichotomisation, we hypothesised that strategies requiring attentional engagement would be preferred in the low condition (i.e., reappraisal, acceptance, rumination), whereas disengagement strategies in the high condition (i.e., distraction, avoidance, relaxation). Consistently and in agreement with previous findings (Sheppes et al., 2011, 2014), disengagement strategies were used more in the high condition (compared to engagement strategies), whereas engagement strategies were preferred in the low condition (compared to disengagement strategies). Our findings support the strategy-situation fit hypothesis, which postulates that ER strategy choices result from a cost-benefit comparison in terms of the individual's emotional, cognitive, and motivational resources, which will optimise ER based on stimulus intensity (Sheppes et al., 2014).

When looking more in detail at our results, we found that when the context is of higher emotional intensity, individuals favour disengagement strategies resulting in a preference for behavioural avoidance, which reflects the prototypic strategy choice of disengagement. Strategy-choice seems to depend on a cost/benefit balance in terms of resources taxing, with avoidance appearing here to be less effortful. This is in line with previous studies showing that disengagement strategies such as distraction does not seem to challenge cognitive resources (Sheppes & Meiran, 2008). In turn, when emotional intensity decreases (i.e., low condition), participants favour engagement processes resulting in a preference for strategies such as acceptance, possibly suggestive of a cost-benefit comparison in favour of a specific strategy. Acceptance is often considered distinct from other strategies due to the less active modification of emotional experience that it implies (Gross, 2015; Wojnarowska et al., 2020). For instance, Hayes et al. define acceptance as fully experiencing emotions, thoughts, and sensations without trying to change them (Hayes et al., 1999, 2002). Hayes et al. have placed reduced

psychological flexibility - translated as (among other processes) excessive avoidance of experience - as the heart of most (if not all) psychological problems (Hayes et al., 1999). Conversely, acceptance is key to a more meaningful life (Hayes et al., 2002). This is congruent with previous studies showing a frequent use and selection of acceptance in daily life (Heiy & Cheavens, 2014; Wittkamp et al., 2022). Therefore, our results could potentially be explained by acceptance being seen as more easily employed when emotional intensity is low (Lennarz et al., 2019), compared to cognitive reappraisal, which requires more effort (Tamir et al., 2019).

Our exploratory findings additionally suggest that ER skills may have an influence on ER choice: the more ER skills, the fewer distraction and disengagement strategies choices in both conditions. It is possible that higher skills such as acceptance and tolerance help individuals to confront more emotional stimuli, thus favouring engagement strategies such as reappraisal (Wupperman et al., 2008). However, the interaction between the condition and ER skills being tendential (Replication task), further studies are needed to precisely test the hypothesis whereby ER skills could moderate the effect of the condition on ER choice.

Limits

Our study has several limits. First, the strategies options were enforced, preventing from measuring spontaneous choices and probably leading to a bias in individuals who would not have chosen to regulate spontaneously at the identification stage (Gross, 2015). However, it is important to highlight here that the option 'Other' was systematically proposed to participants. Importantly, even if a list of strategies' definitions was offered, the participants' own definitions were not considered, which may have impacted individuals' choices. Furthermore, the number of trials per condition (15) can limit the frequency of selection of certain strategies and have consequences on the power related to the findings. Thus, future studies using such a paradigm should increase the number of trials. Another limitation of our study concerns our sample

characteristics. Indeed, our sample was composed mostly of young females. Previous studies have found that age and sex can impact ER use (Goubet & Chrysikou, 2019; Nolen-Hoeksema & Aldao, 2011; Saeidi et al., 2021). Likewise, many of our participants were undergraduate students in psychology, which might bias their ER choice. We tried to overcome this limitation by recruiting non-student participants ($N = 42$) and including only students from the first three years of a psychology degree who have less deep knowledge of ER. Finally, the images used as stimuli may not be necessarily personally-relevant, reflecting only a part of daily emotional stimuli individuals can encounter. Future studies are encouraged to evaluate individuals' choices in daily settings, for example, through experience sampling methods using event-related questionnaires.

Conclusion

This study provides additional evidence of the importance of measuring context while studying ER processes by showing that individuals indeed make different choices when the context changes. Most importantly, we showed that it is still the case when participants are given a wider range of ER strategy choices. That is, individuals tend to use disengagement strategies when facing high-emotional intensity contexts while preferring engagement strategies in low-emotional contexts. In sum, the current study increases theoretical knowledge on ER by strengthening Sheppes et al.'s theory depicting the influence of context (emotional intensity) on ER choice and, more precisely, on the use of typical disengagement strategies in high-intensity and engagement strategies in low-intensity contexts. However, whether all strategies can be strictly classified between the two categories remains to be clarified.

Future studies should consider other contextual characteristics that have been identified as possibly influencing strategy choice (Aldao, 2013). For instance, goals pursued to regulate emotions should also be considered more deeply in future studies, given their implication in ER

choice (Tamir et al., 2020). Indeed, recent studies have shown that goals greatly influence ER choice, such as whether individuals are motivated to increase or decrease emotions (e.g., Millgram et al., 2019), suggesting that deficits in ER can partly be related to difficulties in ER goals (Millgram et al., 2020).

CHAPTER 2 - CONCLUSION

This second chapter aimed at addressing current issues related to methodological and measurement aspects of ER flexibility. The validation study provided a French instrument to measure two components of flexibility. The systematic review revealed that both experimental and daily designs are promising tools to catch ER dynamics. Both these methods can give precious information on what should be the target of clinical interventions in ER. Based on the systematic review's results, we have replicated and extended an experimental paradigm on ER choice and have explored the influence of ER skills. The two first chapters have addressed conceptual issues and data for understanding non-problematic functioning. The next chapter will explore the extent to which we can formalise clinical interventions to increase flexibility and, on the basis of all the empirical and theoretical work developed so far, the way in which we can test this increase in flexibility through a randomised controlled trial undertaken during this thesis.

CHAPTER 3. EMOTION REGULATION AND FLEXIBILITY IN CLINICAL INTERVENTIONS

The chapter will address ER clinical interventions with a specific focus on the Affect Regulation Training, the hypothesis of flexibility as a mediating variable in the efficacy of interventions, and the related challenges. The chapter will end with the presentation of the RCT conducted during this thesis.

This chapter is not intended to review the implication of ER disorder by disorder. Instead, we will introduce the transdiagnostic nature of ER in anxiety and mood disorders as an illustration, since the RCT presented at the end of this chapter includes anxious and depressive symptoms as outcomes.

Anxiety disorders have in common the experience of intense emotions, often perceived as threatening or unwanted and leading to efforts to diminish or avoid aversive emotional experiences (Barlow et al., 2002; Rapee & Barlow, 2002). All steps of the ER process can thus be implicated, from attentional deployment (e.g., hypersensitivity to threat) (Beck & Clark, 1997; Pineles & Mineka, 2005) to an over-reliance on disengagement strategies in the selection stage (e.g., behavioural avoidance) (Hofmann et al., 2012). Hence, numerous studies have investigated ER in anxiety disorders, highlighting difficulties in emotional clarity (e.g., Boden et al., 2013), decreased acceptance (e.g., Weiss et al., 2012), and poorer access to strategies (e.g., Mennin et al., 2009).

ER disturbances have also been identified in mood disorders in relation to the sustained states of negative affect and decreased positive affect (Joormann & Siemer, 2014; Joormann & Stanton, 2016). A well-documented ER challenge in depression is the misuse of specific strategies - such as the overuse of rumination (Nolen-Hoeksema, 1991; Nolen-Hoeksema et al.,

2008) and the restricted use of reappraisal (Garnefski et al., 2001) - that has been linked to mood-congruent biases, for example, perceived benefits of rumination (MacLeod & Mathews, 1991; Papageorgiou & Wells, 2001).

Beyond anxiety and mood disorders, most psychological difficulties can be understood as disrupted emotional experiences (Nowak et al., 2021), and deficits or biases in ER are entailed in various forms of psychopathology (Aldao et al., 2010). Therefore, enhancing ER has been incorporated into diverse clinical interventions as a promising transdiagnostic treatment target (Berking et al., 2008; Mennin & Fresco, 2009; Moses & Barlow, 2006). Even if specific treatments have been developed to improve ER, it seems that most psychological interventions indirectly target ER at some point, to the extent that they foster the development of ER strategies and skills. Accordingly, the next session will give examples of ER non-specific and specific treatments.

1. Aren't all clinical interventions ultimately about emotion regulation?

Studies have shown that targeting ER can improve mental health (Cherry et al., 2021). Indeed, adaptive ER skills could promote mental health by helping individuals to cope with negative life events and stress (Aldao et al., 2015; Gross & John, 2003). That is why various therapeutic approaches aim at strengthening - explicitly or not - ER abilities (Leahy et al., 2011).

A first set of therapies indirectly addresses ER, such as Cognitive and Behavioural Therapy (CBT), through the use of, for example, exposure interventions aiming at decreasing negative emotions or cognitive restructuring techniques (Lincoln et al., 2022). Training of specific strategies is part of CBT, with a focus on cognitive strategies (e.g., reappraisal), associated with strategies oriented on the response (Beck & Beck, 2011) or with the reduction of rumination (Denny, 2020; Watkins & Roberts, 2020). Consistently, CBT has been found to

improve ER (e.g., Goldin et al., 2012; Spinhoven et al., 2017) or at least to foster the use of specific strategies (e.g., Kivity et al., 2021; Strauss et al., 2019).

Other approaches can be described, to a certain extent, as focusing on specific skills. For example, a major component of Acceptance and Commitment Therapy (Hayes et al., 1999) is based on developing acceptance (e.g., Spidel et al., 2018) and has been found to enhance the use of ER strategies (e.g., Yaraghchi et al., 2019) and skills (e.g., Norouzi et al., 2017). Moreover, mindfulness-based approaches, such as Mindfulness-Based Cognitive Therapy (Segal et al., 2002) or Mindfulness-Based Stress Reduction (Kabat-Zinn, 2003), have been evidenced to strengthen ER (e.g., Segal et al., 2002) and has thus been incorporated in many ER treatments (Lincoln et al., 2022).

Concurrently, ER has explicitly been targeted by several treatments. Dialectical Behavioural Therapy (DBT - Linehan et al., 1993) addresses techniques such as mindfulness, distress tolerance, ER and interpersonal effectiveness that can be applied to regulate emotions. Even though primarily developed for borderline personality disorder, DBT has been used across various disorders (Robins & Chapman, 2004) and found effective in improving ER, although the studies show high variability (e.g., Harvey et al., 2019).

A range of therapies targeting ER have been developed simultaneously for emotional disorders (i.e., the experience of frequent and intense negative emotions, an aversive reaction to the emotional experience itself, and efforts to dampen, escape, or avoid the emotional experience, Bullis et al., 2019, see p.16), going beyond classic nosography. For example, Emotion Regulation Therapy (ERT – Mennin & Fresco, 2009) was initially developed for Generalised Anxiety Disorders and Major Depressive Disorders and integrates techniques from both CBT (e.g., psychoeducation, self-monitoring, problem-solving) and emotion-focused interventions (e.g., acceptance-, mindfulness-based treatments), with the goal of increasing motivational awareness, regulatory capacities, and repertoire. Several RCTs have evidenced the

efficacy of the ERT in improving symptoms and quality of life (Mennin et al., 2015). Likewise, Emotion Focused Therapy (EFT - Greenberg, 2010) and the Unified Protocol (UP - Barlow & Farchione, 2017), have been developed. The UP is mostly based on three therapeutic components comprising training cognitive reappraisal, preventing avoidance, and enhancing actions that are not associated with the dysregulated emotion (Barlow, 2018). Even though various evidence exists on symptoms reductions (e.g., Carlucci et al., 2021; Sakiris & Berle, 2019), the UP has received only small to moderate evidence on its efficacy on changes in ER strategies (e.g., Sakiris & Berle, 2019; Topper, 2016).

Taken together, it seems that almost all current psychotherapeutic treatments work to improve ER in some way, but most of them assume enhancing this process through the application of other approaches (e.g., personal growth, self-understanding, acceptance, etc.). As such, the specific therapeutic ingredients implicated in ER improvement remain unclear. Taking a step back to the theoretical models of ER, it seems that different treatments focus on different stages of the ER process (Gross, 2015). The identification stage is mostly addressed through the training of skills such as emotional awareness in Mindfulness-based practices; the selection stage is often manipulated by the learning of new strategies (e.g., cognitive restructuring); the implementation stage can be targeted by strategy-specific training (e.g., reappraisal). Although we acknowledge that some treatments might be targeting all stages in different ways (e.g., CBT, DBT, ACT, Mindfulness-based interventions), this has not been formally assessed yet.

If one could suggest that the majority of psychological treatments target ER at some point, one could wonder about whether it fosters ER flexibility. As many therapeutic treatments aim at enhancing the behavioural repertoire of individuals and, often, the ER repertoire, one can consider they also act, at least partially, on flexibility, even when it is not explicitly defined as a therapeutic goal. Beyond ER programs, therapy may increase flexibility by teaching various strategies (e.g., reappraisal), skills (e.g., awareness) and new behaviours (e.g., through

exposure). Overall, therapy trains individuals to adopt [flexibly] different behaviours to adapt to situations and goals (e.g., values in the ACT framework).

From the different interventions mentioned above, the Affect Regulation Training program (ART - Berking & Whitley, 2014) was built in line with the Adaptive Coping with Emotions model (ACE – Berking & Whitley, 2014) to address ER skills in a transdiagnostic group intervention. It is the focus on commonalities across various mental disorders that distinguishes the ART program from other treatments targeting ER explicitly (e.g., ERT; DBT). Moreover, this intervention was developed with the inherent goal of improving mental health through the implementation of psychological interventions specifically targeting the promotion of ER skills. Therefore, it appears promising to improve both general ER skills required in all steps of the ER process (Gross, 2015) and specific ER strategies that are to be applied depending on context and goals (i.e., flexibility - Aldao et al., 2015).

2. The ART program: a transdiagnostic intervention on emotion regulation

The ACE model (see Figure 2, Chapter 1, p.14) was developed according to affect regulation theories (e.g., Grawe, 2017; Larsen, 2000; Lazarus, 1991; Salovey & Mayer, 1990) and empirical findings regarding ER and psychopathology (e.g., Lukas et al., 2018). The ACE model conceptualises a situation-dependent interaction between several ER skills and proposes that an adaptive ER would consist of the interplay of these more general skills (see Box 1).

Box 1: Seven ER skills described in the ACE model (Berking & Whitley, 2014)

The ability to be consciously aware of emotions is the basis of regulation. Indeed, conscious ER can only be applied if one is aware of its emotional state, which allows for the subsequent use of skills that require cognitive resources (e.g., labelling the emotion, identifying its causes, etc.).

The ability to identify and correctly label emotions refers to the appropriate selection of semantic categories that matches the emotional experience (e.g., *This emotion I am feeling is sadness*). Properly labelling emotions requires owning a whole system of cognitive representations for emotions, needed to use knowledge about this state (e.g., which information – nature and purpose - does this emotion provide) and to appropriately select an ER strategy.

The ability to understand causes (e.g., cues) and maintaining factors of an emotion is involved in the normalisation of an emotional state and helps to give meaning to the experience.

The ability to modify emotions, or at least its quality, intensity and/or duration can increase self-efficacy and avoid the use of ineffective strategies (e.g., An et al., 2022; Catanzaro & Greenwood, 1994). This modification can include various techniques, such as problem-solving or positive activities.

The ability of acceptance and tolerance are crucial skills in the ACE model. Whenever emotion cannot be changed, the option to tolerate and accept emotions can prevent from using ineffective strategies (Wupperman et al., 2008).

The ability to approach and confront situations that might generate difficult emotions is very often necessary to keep pursuing personally relevant goals (Hayes et al., 1999).

The ability to compassionately support oneself is essential for the proper application of other skills that can increase difficult emotions in the short term (e.g., identifying emotions such as fear or anger can cue further difficult feelings). Self-soothing, self-encouragement are thus needed to prevent further deterioration of the individual's mood. Also, individuals suffering from mental disorders often demonstrate high self-criticism, thus encouraging self-compassion may improve ER efficacy.

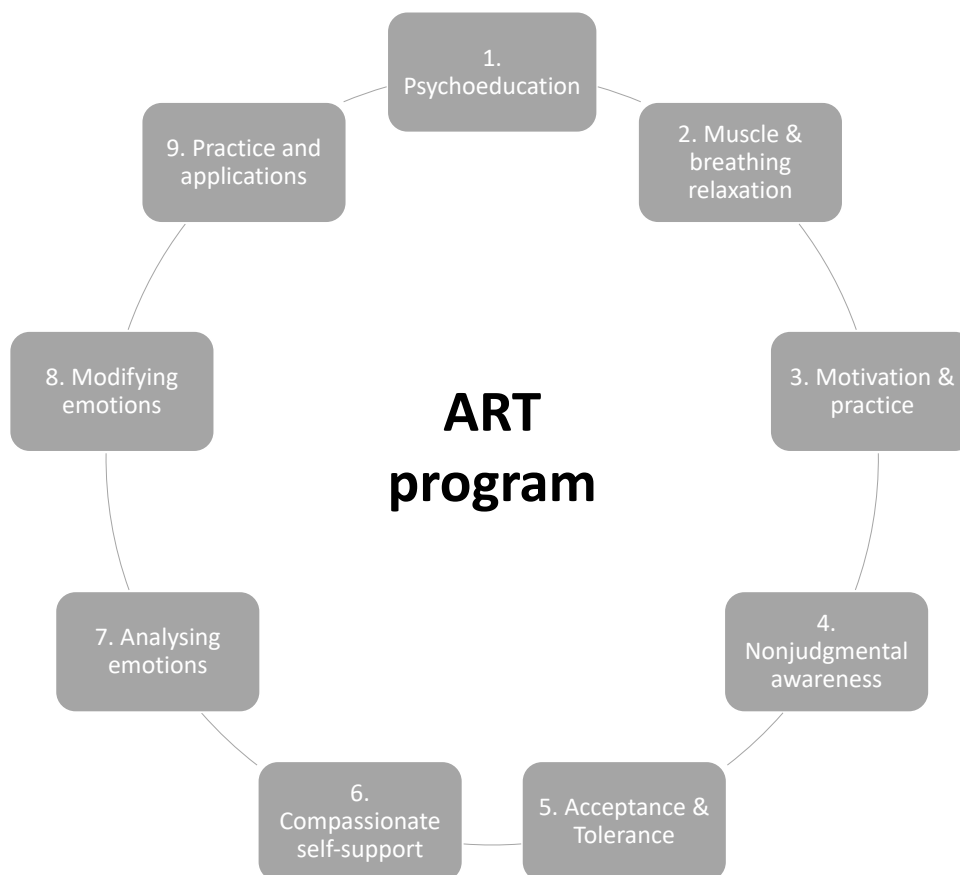
This model exceeds common perspectives on ER (i.e., adaptive vs maladaptive strategies) and provides a new opportunity for individuals to enhance those skills to later adapt ER strategies to contextual demands. Upon managing general ER skills, individuals could upgrade their ability to flexibly match their ER strategies to the context (i.e., flexibility). However, to our knowledge, this hypothesis has not been investigated yet.

2.1. The ART skills

The ART program integrates techniques from CBT, compassion-based therapy (Gilbert, 2015), DBT, EFT, ERT, mindfulness-based interventions, neuro-psychotherapeutic approaches (Grawe, 2017), problem-solving therapies (D’Zurilla & Nezu, 2010), etc. (Berking et al., 2015). It focuses on the development and implementation of seven skills (see Figure 1 for an overview) through concrete techniques including relaxation, non-judgmental awareness, acceptance and tolerance of negative emotions, self-support (e.g., self-compassion, Gilbert, 2015), analysis of the causes of one’s emotions, and modification of emotions if possible and required (e.g., problem-solving approach, D’Zurilla & Nezu, 2010). In other words, it is a combination of ER skills to minimise difficult emotions, accept and tolerate them, and increase positive emotions. Furthermore, ART is approach-oriented, helping participants to identify and pursue approach goals and thus achieve something important (e.g., regulating my anxiety to be better prepared to give a speech), as opposed to avoidance goals (e.g., avoiding internal or external situations associated with anxiety). In practice, each skill is theoretically introduced (i.e., from a vicious circle created by the emotion to the benefits of the skill) before being practised, both during the session and after, through recommended exercises (See Study 5 p. 176 for a description of the sessions). The program is composed of nine sessions of two hours in groups, with a first session addressing psychoeducation on emotions and ER and a third session on motivational aspects. Participants are provided with a manual summarising each skill theoretically, accompanied by written exercises and audio files.

Figure 1

Overview of the ART skills (adapted from Berking & Whitley, 2014)



2.2. Evidence of the efficacy of the ART program

Since its first development, the ART program has become quite popular in Germany (*Training Emotionaler Kompetenzen - TEK*, Berking & Hondong, 2018). Thereafter, several studies have evaluated the efficacy of the ART on ER skills and psychopathology. A summary of these studies is presented in Table 1. Studies with non-clinical samples have demonstrated preliminary evidence of its efficacy in enhancing ER skills (Berking et al., 2010; Buruck et al., 2016) and reducing symptoms of anxiety, depression, and stress (Lotfi et al., 2020).

Moreover, a study in a clinical sample including various disorders demonstrated that integrating ART into CBT was associated with better outcomes (Berking et al., 2008); those findings having been replicated in a RCT conducted with patients suffering from Major Depressive Disorder and that showed reduced negative affect and increased ER skills and well-being compared to patients receiving CBT only (Berking et al., 2013). Other RCTs have shown that ART, as a stand-alone intervention, was effective in reducing Binge Eating Disorder (Berking et al., 2022) and MDD compared to a waiting list control group (Berking et al., 2019). Another study found that ART was even more effective than CBT to reduce alcohol use and negative affect and to increase mindfulness (Stasiewicz et al., 2013). However, it is worth mentioning that one of the RCTs showed no superiority of the ART group over a non-specific comparison condition (Berking et al., 2019). Consistently, a recent study found evidence for the ART program in improving ER skills but no difference with an ER self-help program for other mental health outcomes (Wittkamp et al., 2023), which is in line with another study's findings comparing ART to a CBT group (Kleinstäuber et al., 2019).

Table 1*Summary of previous studies evaluating the ART*

Article	Sample type	Control group	Main findings
Berking et al., 2010 (N = 27)	Non-clinical – police officers	ART vs Waiting-list	Enhancing ER skills
Buruck et al., 2016 (N = 96)	Non-clinical – employees in elderly health care	ART vs No intervention	Enhancing ER skills and well-being
Lotfi et al., 2020 (N = 32)	Subclinical – anxiety and depression	ART vs No intervention	Greater decrease in anxiety, depression and stress, and greater increase in ER skills and social adjustment
Berking et al., 2022 (N = 101)	Clinical - BED	ART vs Waiting-list	Greater decrease in binges and greater reduction in general eating disorder and depression. Partial mediation of the reduction in BE by increased ER skills
Berking et al., 2019 (N = 218)	Clinical - MDD	ART vs Waiting-list vs condition controlling for common factors	Greater reduction in depression in the ART group compared to the WL but similar to CF. Mediation of the ER skills in the differences between groups
Berking et al., 2008 (N = 535)	Clinical – MDD (25%), recurrent depressive disorder (23%), adjustment disorder (22%), panic disorder (5%), PTSD (3%), somatoform pain disorder (3%), dysthymia (2%)	ART+CBT vs CBT-based treatment as usual	Both the CBT and ART+CBT groups increased in ER skills, with a greater increase of ER skills and greater reduction in depression and negative affects and increased positive affects in ART group
Berking et al., 2013 (N = 432)	Clinical - MDD	ART vs CBT-based treatment	Greater reduction in depression and negative affect and greater increase in ER skills and well-being
Wittkamp et al., 2023 (N = 138)	Subclinical – psychotic, depression, anxiety	ART vs Self-help bibliotherapy	Greater improvement of ER in daily life, but no superiority in preventing the transition to mental disorders
Stasiewicz et al., 2013 (N = 77)	Clinical – Alcohol Use Disorder	ART vs CBT and healthy lifestyle	Greater reduction in alcohol use, decreased negative affect, increased mindfulness
Kleinstäuber et al., 2019 (N = 255)	Clinical – Medically Unexplained Symptoms	ART vs CBT	No difference between groups except for a superiority of ART in enhancing specific ER skills

Overall, preliminary evidence supports the efficacy of the ART program as a treatment for various mental disorders, although mixed findings seem to depend on the type of control condition: while preliminary evidence emerged when compared to waiting lists or no-intervention conditions, results are less clear-cut when compared to active conditions (e.g., CBT, common factors, self-help). The discrepant findings related to the choice of control group will be addressed in the last part of this section. Still, these preliminary findings are in line with the hypothesis that the ART can be considered transdiagnostic and, therefore, ER difficulties important targets of treatment.

2.3. The potential impact on emotion regulation flexibility

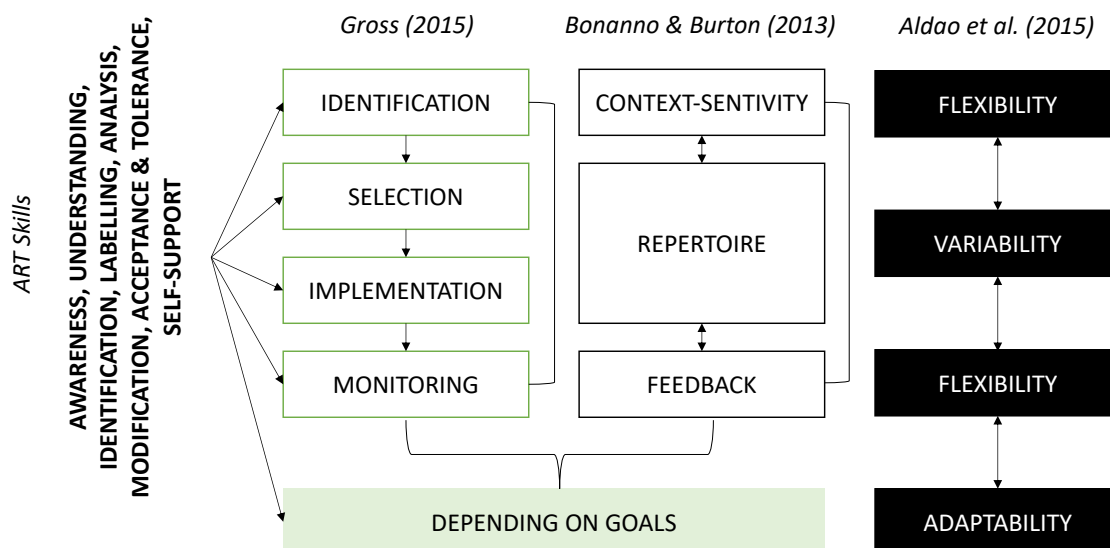
By teaching a variety of ER skills, the ART program implicitly targets ER flexibility. To enhance flexibility, a large *repertoire* of strategies is required (Bonanno & Burton, 2013), even though insufficient by itself (Aldao et al., 2015). By practising more general skills (e.g., awareness, acceptance, modification), it is postulated that individuals will be more inclined to apply different strategies depending on the context (*selection* stage – Gross, 2015). For example, self-support can be considered a baseline skill that will facilitate the implementation of ER strategies (e.g., reappraising can be found easier if the individual is self-soothing). Also, skills such as clarity, non-judgemental awareness, and understanding are considered a solid foundation to implement strategies (e.g., Kuppens & Verduyn, 2015; Morris & Mansell, 2018). For example, individuals who are hardly aware of their emotions can have difficulties in problem-solving or in seeking support.

Moreover, such skills (i.e., awareness, clarity, understanding) are part of the abilities described in the *context sensitivity* component described by Bonanno and Burton (2013). ER strategies can be applied adaptively only if the context is adequately evaluated, and thus skills

such as awareness, clarity, and understanding are of major importance. Relatedly, these skills foster the capacity to identify whether there is a need to regulate (referring to the *identification* stage of the ER process – Gross, 2015). They can also be understood as the basis for efficacious monitoring in the *feedback* component to the extent that they facilitate the *monitoring* of the regulation (being aware of one’s emotion dynamics to decide whether its regulation is efficient or not). Moreover, the two last sessions of the program specifically aim at increasing the individuals’ repertoire while concurrently raising awareness of the multiple factors (both external and internal) influencing an emotional experience. As mentioned above, the ART program also sheds light on the individual’s goals, which complement the indirect training of flexibility in agreement with Aldao et al.’s definition (i.e., adaptability – Aldao et al., 2015). These ideas are summarised in Figure 2 below.

Figure 2

ART skills target on ER processes



Considering that we can hypothesise flexibility to be enhanced by the ART skills, it is of primary interest to further test whether this treatment is indeed effective in improving mental health through its impact on ER flexibility.

3. Considering flexibility as mediating changes in the intervention's efficacy

Hypothesising flexibility as a potential mediator in the efficacy of ER skills to improve mental health, the next section is dedicated to exploring the theoretical support for this assumption as well as the challenges associated with the measure of a mediator and, more specifically, of flexibility as a mediator.

3.1. Mediating role of flexibility (theoretical approach)

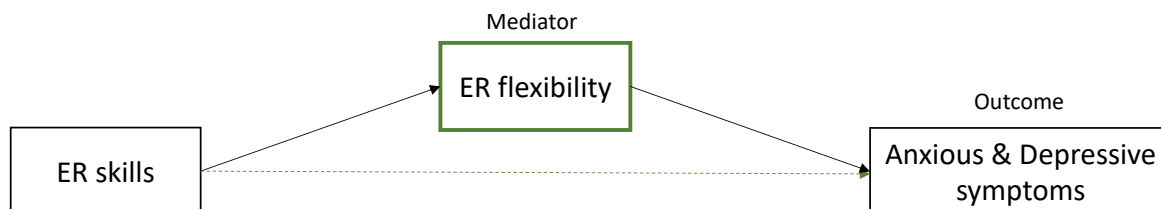
Several authors have stressed the importance of understanding the processes mediating the therapeutic effect of an intervention on mental health (e.g., Ciarrochi et al., 2021; Hofmann & Hayes, 2019). Studies generally focus on assessing whether a treatment works on a set of outcome measures, but less is known about *how* it operates (Windgassen et al., 2016). Thus, it seems fundamental to better understand the processes implicated in the effect of psychological interventions on mental health to pinpoint the keys of change in therapy and thus better specify our treatments (Kazdin, 2007). A mediator is a variable that accounts for the relationship between the treatment and the outcome, an intermediate variable that (at least partially) explains why the treatment is effective (Kazdin, 2007). As such, identifying mediators can help better understand how treatments produce changes, also by elucidating which common mechanisms are involved in different treatments (Vlaeyen & Morley, 2005). In turn, mechanisms of change are defined as ‘processes or events that are responsible for the change, the reasons why change

occurred or how change came about' (Kazdin, 2009, p.3). Even though *mediator* and *mechanism* are often used interchangeably (Tryon, 2018), a mediator is not necessarily a mechanism of change but can be considered as a mean to reveal mechanisms of change (Lemmens et al., 2016). Instead, a mechanism of change can be considered as a sequence of causal events (Tryon, 2014). Such a sequence is challenging to identify and measure in clinical psychology since it requires a fine-grained understanding of various phenomena, including cognitive factors (e.g., attentional processes) (Kangaslampi & Peltonen, 2022).

Flexibility in the use of ER strategies (Aldao et al., 2015), in the case of ART, is a promising candidate to act as a mediator between the intervention and the outcomes. For example, the improvement of ER skills, such as awareness and modification, could enhance the ability to switch strategies (by increasing context-sensitivity and the repertoire's size) depending on the context (i.e., flexibility), thus acting on mental health by providing individuals with new ways of responding, possibly helping them achieving personal goals. Indeed, by improving ER skills, ER flexibility could be enhanced and eventually help further understand how clinical interventions for ER work (Cuijpers, 2019; Cuijpers et al., 2019). We tried to illustrate flexibility as a mediator in Figure 3.

Figure 3

Flexibility as a hypothesised mediator



3.2. Challenge of measuring flexibility as a mediator

Measuring a mediator or a mechanism of change can be challenging since it necessitates several steps. First, a strong association must be demonstrated between the intervention and the variable and between the variable and the outcomes. Second, consistency must be evidenced through replications studies. Third, change in mechanisms and mediators should temporally precede change in outcomes (Kazdin, 2007). More importantly, such variables need to be accurately measured. This prerequisite is not easily addressed with psychological constructs, and specifically with flexibility. Hence, it appears that testing flexibility as a potential mediator is associated with both common obstacles related to mediator measurement and specificities of this variable.

3.2.1 Temporal challenges (as for all mediators)

Randomised Controlled Trials (RCTs) seem well suited to delineate such variables. However, most clinical interventions have limited their evaluations to pre- and post-intervention measures (e.g., Berking et al., 2019), which often restrains a temporal relationship to be established and, more specifically, on the precedence of change in the mediator compared to change in the outcomes.

Moreover, these pre- and post-measures (as well as the use of questionnaires) do not consider the link between ER and context and hence go against current conceptualisations of ER, encouraging the measure of variability, flexibility, and adaptability (Aldao et al., 2015). They suggest, for example, the addition of weekly reports between sessions detailing the situation in which an emotion occurred, the emotional experience, the goals pursued, the importance of these goals, the ER strategies employed and their effectiveness in facilitating goal achievement. This recommendation is in line with the conditions needed to explore the

role of potential mediating variables (Cuijpers et al., 2019). Accordingly, daily measurement methods can be considered promising tools for the measure of flexibility.

3.2.2 Specific challenges related to flexibility using ESM

The literature advocates assessing flexibility by considering the context in which the regulation occurs (Aldao et al., 2015), which can be addressed by daily assessments, which would allow for a better understanding of the impact of interventions in everyday life (Csikszentmihalyi & Larson, 2014).

The ESM allows us to go beyond pre- and post-intervention measures in questionnaire format or beyond weekly measures. More precisely, it is a random time sampling self-report technique that allows us to assess emotions, cognitions, and ER strategies, as well as their context of occurrence in daily life (Csikszentmihalyi & Larson, 2014). This method allows testing how within-individual changes in one variable can impact changes in other variables later in the same day (Csikszentmihalyi & Larson, 2014). Therefore, the ESM can be used to assess the effects of psychological intervention in daily life and, more specifically, in the variability of ER strategies, skills, and flexibility (Aldao et al., 2015). More specifically, the ESM allows us to assess both the context in which the individual is (e.g., where, who with, activity) and the strategies they apply to deal with their emotional experience simultaneously. Hence, it gives the opportunity to investigate whether a change in context implies a change in strategy choice (Aldao, 2013). In addition, conducting pre-, mid-, and post-intervention ESM samples enables us to measure whether this covariation evolves as the intervention progresses.

However, ESM is also associated with important drawbacks, which can be summarised as a constant trade-off between getting sufficient information and limiting the participants' burden. Moreover, several indices have been developed with the goal of catching a flexibility index (e.g., standard deviation being the most widely used). However, no consensus has

emerged so far regarding the most accurate method to choose. Since flexibility implies a balance between stability (e.g., sticking by one's goal) and variability (e.g., adapting to contextual changes) (Dreisbach & Fröber, 2019; Pruessner et al., 2020), a unique index per participant would possibly erase the dynamics of the process, leading researchers to face a complex challenge to operationalise an indicator of flexibility (Wenzel et al., 2021).

3.2.3 Determining flexibility as an active ingredient: the control group choice challenge

Determining the type of control group is very debated in the elaboration of a randomised controlled trial. The primary goal of this additional arm is to control for the variance associated with non-specific factors and confounding variables (e.g., the natural evolution of the patient, placebo effect, etc.). The most common options in clinical trials are waiting-lists, no treatments, treatment-as-usual, and psychological placebo or other active control conditions. However, each of them is associated with drawbacks that can limit the findings' interpretations.

More precisely, no treatment and waiting-list control groups lead to limited inferences because significant differences between groups mostly indicate that '*it is better than doing nothing*' (i.e., or waiting) (Guidi et al., 2018). They do not control for common factors (e.g., therapeutic alliance) or placebo effects (e.g., patient's expectations) (Guidi et al., 2018). Waiting-lists have even been assumed to have *nocebo* effects (Furukawa et al., 2014): while waiting for future treatment, it is possible that participants are less proactive in seeking help and can therefore see their difficulties worsening (Cuijpers et al., 2019). In turn, treatment-as-usual conditions often display a large variability that limits the results' interpretations. In turn, offering the same amount of time and attention from a professional figure but without the specific ingredients (Psychological placebo, Guidi et al., 2018) controls for the placebo effect.

However, such an option can suffer from low acceptance by participants and increase dropout rates, so this option does not constitute the ideal solution either.

Overall, the interpretation of the effect size associated with an intervention¹⁸ is dependent on the control condition (Newby et al., 2016). In a recent meta-analysis, Michopoulos et al. (2020) found that the control group option led to diverse effect sizes for a similar intervention, the weakest option being waiting-list (i.e., greater effect sizes). Conversely, a psychological placebo was found to be the most robust control option.

Another possibility, the component-specific control group (Kazdin, 2016) has been developed. It corresponds to a reduced number of specific components and has been, for example, chosen by Berking et al. (2019), comparing the ART + CBT to a CBT-only condition. As such, they were able to isolate the impact of the ART program from other CBT ingredients. A less chosen option is to submit the control group to a treatment (Active Comparator), which has been found effective in other studies (Gold et al., 2017). One active comparator used several times is the Relaxation-based intervention (e.g., Kabat-Zinn et al., 1992). A relaxation group condition appears well-suited for comparison with an ART condition. Indeed, one could expect this control group to have an effect on anxious and depressive symptoms (Francesco et al., 2010; Kim & Newman, 2019; Manzoni et al., 2008) without addressing flexibility (i.e., without being mediated by flexibility improvement). Although relaxation can be considered an ER strategy and is part of the ART program, focusing on diverse techniques of relaxation does not address various ER skills and can, therefore, be hypothesised as not overlapping with flexibility.

¹⁸ One could distinguish an ‘absolute’ efficacy (i.e., pre- and post- comparison) from an ‘relative’ efficacy (i.e., between-groups comparison).

4. Study 5: REFLEX: a RCT to test the ART's efficacy

**REFLEX: A Randomised Controlled Trial to test the efficacy of an Emotion Regulation
program on mental health among university students**

Manuscript in preparation

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Preregistration, data, material, and supplementary material:

https://osf.io/28xh6/?view_only=60df7e1b876b47fba06e4d42b1f63146

Abstract

The *Affect Regulation Training* was built in line with the ACE model (Berking & Whitley, 2014). This intervention aims at improving ER, by teaching essential skills towards adaptive regulation. To date, no study has tested its efficacy on a French population. Thus, the goal of this randomised controlled trial is to test its efficacy in French university students, on mental health outcomes (depressive and anxious symptoms) and ER skills. Moreover, considering recent models on ER flexibility, the second aim of this RCT is to operationalise indices of variability, both in strategy-use and in contextual change to test the potential mediating role of flexibility in the efficacy of the intervention. So far, 27 participants have been included and attended either the nine-session ART or an active control group of Relaxation. Preliminary analyses suggest that the ART is effective to improve mental health and enhance ER skills. Moreover, exploratory findings suggest that both interventions decrease strategy-variability, emphasising the distinction between ER strategies and skills. However, findings must be replicated on the complete sample to explore more precisely the role of flexibility.

Keywords: randomised controlled trial, emotion regulation, emotion regulation flexibility, university students.

Introduction

University is a critical period for mental health. University students face various transitions in their lives, often accompanied by financial difficulties and academic stress (Verger et al., 2009). Consistently, research has shown decreased well-being and increased risk of psychological difficulties in this population (Conley et al., 2013; Sheldon et al., 2021), such as higher levels of depression (Lim et al., 2018). University students are also particularly vulnerable, considering the peak onset of mental health development occurring before 24 years old (Kessler et al., 2005).

Mental health problems among students have become a focus of attention in the French media because of the precarious situations of many students and the lack of attention devoted to their mental health. Recently, Morvan et al. (2019) found that 8.4% of students in France have thought about suicide in the last 12 months (compared to 4.7% in the general population - *Baromètre santé 2017*) and 4.4% have attempted suicide in their lifetime (compared to 0.3-0.7 for the general population – Inpes, 2011). Furthermore, one in four students in France has been diagnosed over the last year with a mental disorder, and of these, about 52% had a marked or extreme impairment in their studies and social relationships (Verger et al., 2009). Nevertheless, most of them have not sought professional help in the past year (Frajerman et al., 2019) due to factors such as perceived stigma (Levin et al., 2016), lack of contact with the mental health system, or cost constraints (Montagni et al., 2019).

It is, therefore, fundamental to provide students with better access to psychological interventions. Another concern regarding student mental health is to provide them with an intervention that targets the range of problems they can describe (e.g., anxiety, depression, eating or substance use problems, etc.). One solution to this challenge is the adoption of a transdiagnostic approach, which allows for an understanding of the processes underlying several mental disorders (Harvey et al., 2004). Emotion Regulation (ER) deficits are deemed a

maintenance factor of multiple mental health problems (Aldao et al., 2010; Kring & Sloan, 2009), they are, therefore, considered a transdiagnostic factor (Aldao et al., 2015). Given the transdiagnostic approach of the *Affect Regulation Training* (ART – Berking & Whitley, 2014), university students constitute a suitable population to test its efficacy. Improving ER could facilitate recovery from anxiety and depressive disorders (Mennin & Fresco, 2009), prevent future mental health problems, and promote resilience in the face of adversity (Fried & Chapman, 2012).

Substantial evidence suggests adaptive ER depends on contextual variables (see Chapter 2). Thus, authors now conceptualise adaptive ER as closely dependent on context, labelling this ability ER *flexibility*. Flexibility in the use of ER strategies (Aldao et al., 2015) is a promising candidate for acting on mental health. However, most clinical interventions have limited their evaluations to pre- and post-intervention measures and questionnaires that do not allow to consider the link between ER and context. Instead, Experience Sampling Method (ESM) is well-suited to explore the covariation between variability in strategy-use and variability in context (i.e., flexibility). ESM would allow for a better understanding of the impact of our intervention in everyday life (Csikszentmihalyi & Larson, 2014).

We thus wished to measure flexibility in ER as defined by Aldao et al. (2015) by assessing (a) the variability in strategy-use, (b) how this variability is synchronised with changes in the environment (flexibility) and, consequently, helps the individual pursue their goals (adaptability).

The present study

The general aim of this study was to test the efficacy of the ART (Berking & Whitley, 2014) in a university student population by comparing it to an active relaxation control group. Relaxation is considered one of the skills of ER (Berking & Whitley, 2014). It is defined as a

state marked by a decrease in alertness, heart and breathing rates, and blood pressure, resulting in a feeling of relaxation and well-being (Benson et al., 1974). The first goal is to assess the impact of the ART on mental health (i.e., anxious and depressive symptoms) and ER skills. Secondly, we want to test the mediating role of flexibility in the use of ER strategies on mental health. To this aim, we will compute strategy-variability and contextual-variability while also considering goal achievement as an operationalisation of adaptability (see Data preparation section).

We hypothesised an improvement in mental health for the ART participants, at least to the level of the control group (relaxation). We expected an improvement in all ER skills for the ART group compared to the control group, for whom we expected an improvement in the specific skills implicated in Relaxation practices (e.g., sensations). We hypothesised strategy-variability to be predicted by contextual-variability (i.e., flexibility), and this prediction to be moderated by the group. In other words, we expected that changes in context will lead to more changes in the strategy choices (flexibility) in the ART group. Moreover, we hypothesised the group to moderate the association between contextual-variability and strategy-variability on goal achievement. In other words, we expected that the changes in the context leading to more changes in the strategy choices (flexibility) will lead to increased goal achievement in the ART group. Finally, we expected flexibility (i.e., covariation between contextual-variability and strategy-variability) to act as a mediating variable on mental health improvement, specifically in the ART group.

Method

Participants

Participants were recruited from Grenoble Alpes University, on social media (e.g., Facebook), through mailing lists of the University, and posters and flyers displayed at the

University. They were invited to contact the research team via email to receive more information. If they were still interested, participants were given an appointment at the University for inclusion.

Based on the study by Berking et al. (2019), we expected an effect size (d) of at least .73 for ER skills. Considering a power of 90%, and a first-type risk $\alpha = .05$, a sample size of 31 participants per condition is needed to obtain a significant effect when comparing the intervention to the control group. To account for possible dropouts (estimated at 30%) and given our secondary mediation analyses, 94 participants must be recruited (47 per group). This calculation was performed using GPOWER software in the tab ‘ANOVA: Repeated measures, between factors’¹⁹. Inclusion and non-inclusion criteria are presented in Table 1.

Table 1

Inclusion and non-inclusion criteria

Inclusion criteria	Non-inclusion criteria ²⁰
<ul style="list-style-type: none"> ● Student from our University ● Minimum 18 years old ● Having a smartphone able to download PIEL app ● Able to read, understand, and speak French ● Signed consent form ● ≤ 30 on the depressive symptoms measure 	<ul style="list-style-type: none"> ● Participation in another ER study ● Students in Psychology²¹ ● Individuals concerned by articles L1121-6 to L1121-8 of the CSP (protected individuals: persons deprived of their liberty by judicial or administrative decision, persons under legal protection - guardianship, curatorship, minors) ● Suicide risk ● Anorexia nervosa ● Psychotic disorders ● Substance abuse (heroin, cocaine, ecstasy) <p>Exit criteria: Opposition to participation/withdrawal of consent.</p>

¹⁹ The current analyses (mixed-models) diverge from the initial pre-registered ones (ANOVAs), on which the sample size was calculated. Estimating the sample size using the website <https://jakewestfall.shinyapps.io/pangea/> for mixed models resulted in a sample size of 240 participants, considering an estimated effect size (d) of .30 and a power of 80% for main outcomes.

²⁰ A modification of the protocol was conducted after the first wave of inclusions, to allow the inclusion of participants having psychological or psychiatric treatments.

²¹ A modification of the protocol was conducted after the second wave of inclusions, to allow first year psychology students.

Justification of the criteria:

The criteria based on depressive symptoms is derived from a cut-off score of 30 given the group format of the interventions, excluding severe depressive symptoms (Beck et al., 1996; Kendall & Sheldrick, 2000; Kokou-Kpolou et al., 2021; von Glischinski et al., 2019). Individuals with a score above 30 were referred to specialised facilities. The exclusion of psychology students (except first years) is based on two justifications: on the one hand, the level of knowledge on the theme (studied from the licence 2 in our university), and on the other hand, the risk of interactions with the psychologists, teachers at the UGA. In case of a detected suicide risk or indications for a diagnosis of a disorder listed above, the participant was redirected to specialised structures such as the university health centre. In case of detected high suicidal risk, the participant was referred to the psychiatric emergency services of the University Hospital.

Measures

Inclusion

To assess the criteria for a possible diagnosis of anorexia nervosa, psychotic disorder, and substance abuse, the **Mini International Neuropsychiatric Interview (MINI - Sheehan et al., 1998)** was used. The MINI is a structured diagnostic interview designed to screen a wide range of psychiatric disorders based on the DSM and ICD criteria. The MINI consists of a series of modules, each focusing on a specific psychiatric disorder. For the current study, the modules anorexia nervosa, psychotic disorder, and substance abuse (besides alcohol).

To evaluate depressive symptoms, the **Beck Depression Inventory (BDI II – Beck et al., 1996)** was completed. The BDI II is a self-report questionnaire that measures the presence and intensity of depressive symptoms based on the DSM criteria. It consists of 21 items representing different symptoms (e.g., sadness, guilt, loss of interest, fatigue, etc.). Participants rate the intensity of each over the past two weeks on a four-point Likert scale, ranging from 0

(absence of symptom) to 3 (severe presence of symptom), with scores ranging from 0 to 63. In this study, the total score was used, with higher scores indicating greater severity. In the original article, the internal consistency for the total scale was of .92.

Outcomes

The evaluation pre-intervention consisted of 3 questionnaires and questions on possible psychological and psychiatric treatments.

The **BDI II** was completed again (internal consistency of .89 in our study), along with the **Beck Anxiety Inventory (BAI - Beck & Steer, 1988)**. The BAI was used to assess the severity of anxiety symptoms. This self-report questionnaire consists of 21 items measuring anxious symptoms such as nervousness, fear, irritability, and physical sensations. Participants rate the intensity of each symptom over the past week on a four-point Likert scale, ranging from 0 'not at all' to 3 'severely'. Scores can range from 0 to 63. In this study, the total score was used, with higher scores indicating greater severity. In the original article, the internal consistency for the total scale was of .85 and in our study of .86.

ER skills were measured using the **Emotion Regulation Skills Questionnaire (ERSQ – Berking et al., 2008)**, which comprises 27 items aiming at measuring ER skills as defined in the ACE model (Berking & Whitley, 2014) through nine factors: attention, sensations, clarity, understanding, modification, acceptance, tolerance, confrontation, and self-support. Each subscale is composed of three items, assessed with a Likert scale ranging from 0 'Not at all' to 4 'Almost always'. Internal consistency of the ERSQ subscales ranged from .67 to .96 in the original version. In this study, the internal consistency for the total scale was of .93, and from .64 to .86 for the subscales.

Mediator: the ESM protocol (3 weeks: pre-, mid-, and post-intervention)

To measure ER flexibility, participants had to complete an ESM protocol sending five semi-randomly spread alerts per day for seven days using the PIEL app downloaded on their smartphone during the inclusion. Our protocol included measures of context (e.g., place, alone or not, activity), emotional experience (e.g., type, intensity), ER strategies (the extent to which they applied 13 possible strategies, including an ‘other’ option), short-term goals (the extent to which they were trying to decrease, increase, maintain their emotion, or achieve something), effectiveness of the strategy, longer-term goal (the extent to which it was aligned with the kind of person they want to be). See Supplementary material for a detailed description of the ESM protocol.

Control measures

Two additional measures were included to control for the effect of therapeutic alliance and participants’ expectations regarding the treatment.

First, the therapeutic alliance was measured using the **California Psychotherapy Alliance Scale (CALPAS-Patient version - Gaston & Marmar, 1994)**. This self-report questionnaire measures the quality and strength of the therapeutic alliance between a participant and therapist using 24 items. It consists of several subscales that capture different dimensions (i.e., agreement on goals, tasks, bond, collaboration, etc.). Items are rated on a Likert scale ranging from 1 ‘not at all’ to 7 ‘a lot’. In the original study, the internal consistency for the total scale was of .83 and of .83 in our study. In this study, we used the total score, with higher scores indicating a greater therapeutic alliance. Second, the **Credibility and Expectancy Questionnaire (CEQ - Devilly & Borkovec, 2000)** was completed to assess the credibility and expectancy associated with the intervention. The CEQ is a self-report questionnaire measuring participants’ perceptions of the potential effectiveness of a treatment. It assesses the perceived qualifications of the therapist, the anticipated effectiveness, and the participant’s own

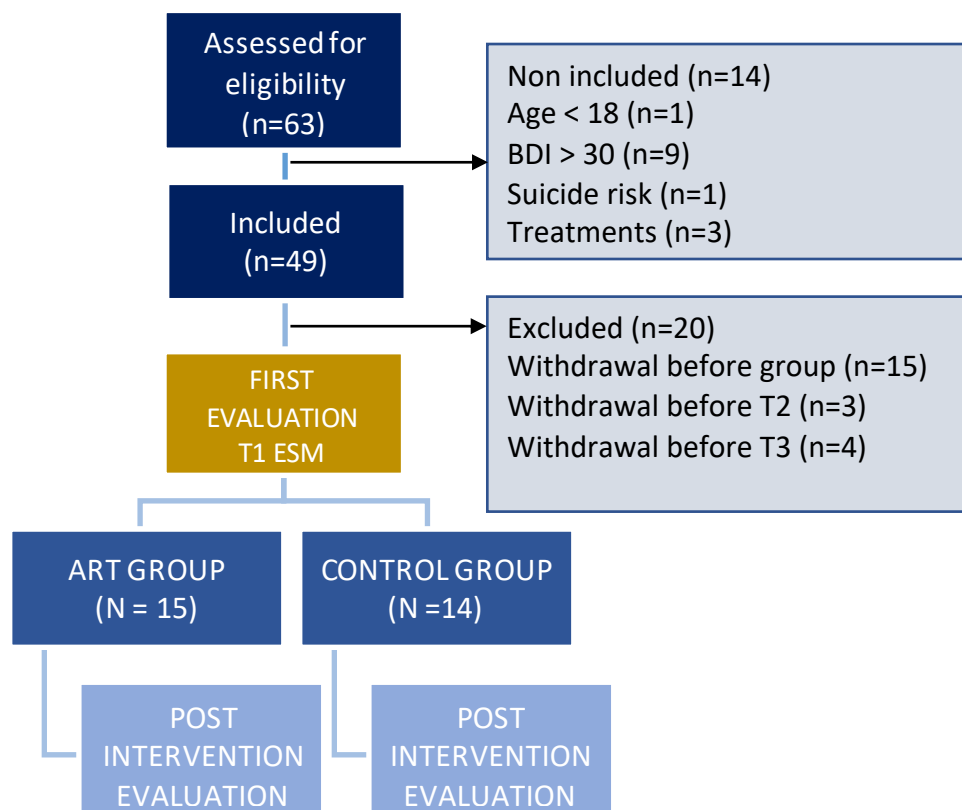
expectations for improvement. Participants rate their agreement with each item on a Likert scale ranging from 1 to 9. In the original study, the internal consistency for the total scale was of .85 and of .90 in our study. In this study, the total score was used, with higher scores indicating greater credibility and positive expectations regarding the treatment's potential effectiveness. In addition, participants were asked to report any change in psychiatric or psychological treatments.

Design and procedure

We evaluate the ART in a monocentric, 2-armed, randomised controlled trial (see Figure 1). The recruitment started in September 2022 and is still ongoing. As such, the current manuscript is based on a partial sample. Participants who meet all the inclusion criteria and none of the non-inclusion criteria are randomly assigned to one of the two groups (ART group or Control group). After creating an anonymous code, participants are invited to answer the first evaluation online. This evaluation measures depressive and anxious symptoms, ER skills, and psychiatric and psychology treatments (see *Measures* section below). They are also provided with information concerning the PIEL app (ESM). The following week, they are invited to answer the first week of ESM before the beginning of the sessions. After the fourth session, participants are asked to complete a measure of therapeutic alliance and treatment expectations and to answer the second week of ESM. After the last session, they are invited to answer the post-evaluation online (BDI II, BAI, ERSQ, CALPAS) and to answer the final week of ESM.

The study procedure was approved by the ethical committee of '*Comité de Protection des Personnes Sud-Ouest et Outre Mer III*' – 2022/05/25 – n°2022-A00378-35. The trial was registered with *ClinicalTrial.gov*, n°2022-A00378-35. The study was preregistered on the OpenScienceFramework:

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Figure 1*Flow chart of the study*

Note. Number of participants included until June 2023.

Interventions (see Table 2 for a description of the sessions)

Affect Regulation Training – see Chapter 3, ART program, p.150

The ART is a nine-session group program that aims at enhancing the following ER skills: muscle and breathing relaxation, non-judgmental awareness, acceptance and tolerance of negative emotions, compassionate self-support, analysis of the causes of one's emotions, and modification of emotions if possible and required (ACE model, Berking & Whitley, 2014). In the program, the skills are individually addressed and then unified into an ART *sequence* that is practised both at the end of each session and at home with audios, progressively integrating the skill addressed in each session.

Active control group – Relaxation program

Dominique Servant's protocol (Servant, 2021) aims at learning to better manage emotions and stress by means of body techniques that have been shown to be effective such as breath control, muscle relaxation (Jacobson, 1987; Öst, 1987), stretch relaxation (Gupta et al., 2006), and visualisation. Autogenic training (Linden, 1993; Schultz, 2018) was also added to the protocol in this research (Ernst & Kanji, 2000), replacing sessions on mindfulness to avoid going beyond relaxation practices and overlap with the ART (Goyal et al., 2014; Kabat-Zinn, 2003; Ludwig & Kabat-Zinn, 2008).

The first psychoeducation session is similar in the two groups. This was set to compare an intervention that proposes different skills that can participate in ER (ART) to an intervention that targets a set of techniques referring to the same skill (Relaxation). This will allow us to specify the role of strategy-variability in the groups.

Table 2*Description of the ART and Relaxation sessions*

Session	ART GROUP		RELAXATION GROUP	
	Content	Skill	Content	Skill
1	Description & organisation Stress & negative emotions	Psychoeducation	Description & organisation Stress & negative emotions	Psychoeducation
2	Vicious circle 1: Amygdala activation and muscular tension Vicious circle 2: Amygdala activation and breathing acceleration	Muscles relaxation Breathing relaxation	Nervous system Importance of breathing Abdominal breathing Counting breaths	Breath control
3	Importance of practice/motivation Description of audio exercises	Psychoeducation	Observing breath Standing breath Slow breath	Breath control
4	Vicious circle 3: Amygdala activation and negative thoughts	Non-judgemental awareness	Muscles tension Upper body Whole body Fast relaxation Auto suggestion	Progressive Muscle Relaxation (Jacobson)
5	Vicious circle 4: Amygdala activation and avoidance	Acceptance and tolerance	Reproducing images Visualisation of the body Visualisation of a situation Visualisation of colours	Visualisation
6	Vicious circle 5: Amygdala activation and self-depreciation	Compassionate self-support	Facial self-massage Stretching exercises	Stretching
7	Vicious circle 6: Amygdala activation and difficulty to analyse emotions	Analysing emotions	Lower cycle Heaviness Heat Lightness	Autogenic training (Schultz)
8	Vicious circle 7: Amygdala activation and difficulty to modify emotions	Modifying emotions	Cardiac regulation Breathing Solar Plexus heat Fresh front	Autogenic training (Schultz)
9	Practice, context & end of group	-	Practices & end of group	-

Data preparation and Statistical analyses

Effect on mental health

To test the efficacy of the ART on ER skills and mental health, we estimated a linear mixed-effects model (Restricted Maximum Likelihood Estimation method) with Group (Relaxation coded -0.5; ART coded +0.5), Time (pre-intervention coded -0.5; post-intervention coded +0.5), and their interaction terms as fixed factors as well as Participant as random factor (with the function *lmer* from the *lme4* R package - Bates et al., 2009).

Effect on flexibility²²

To test the effect of the ART on flexibility, we investigated whether the ART moderated the effect of context variability on variability in the use of strategies, and whether the effect enhanced goal achievement (i.e., adaptability). We operationalised both context variability and variability in the use of strategies through two methods. The first method is based on recent research on emotion dynamics (e.g., Wenzel et al., 2021) suggesting to use the Root Mean Square of Successive Differences to summarise the changes in one variable across several time points. This method leads to a mean value per week, and gives us a strategy-variability index at the week-level (i.e., whether there was a change from week one to the second and third). The second method allows us to investigate the covariation between contextual changes and change in strategy-use from one moment (one alert) to the next, to preserve as much information as possible. This method gives us a strategy-variability index at the alert level (i.e., whether there was a change from one alert to the subsequent one). In both methods, we considered contextual changes through both external (i.e., place, alone or not, who with, activity) and internal context

²² In these preliminary analyses, only the first and last week of ESM were considered to limit the number of parameters in the models (contrasts)

(i.e., emotional intensity). The following variables were created to consider variability as changes from one alert to the next:

(a) External contextual variability: a new variable was created to represent variability in the external context, that is; External Contextual Variability. Changes in the following variables were considered from alert^x to alert^{x+1}: *place, alone or not, who with, activity*.

(b) Internal contextual variability: a new variable was created to represent variability in the internal context, that is; Internal Contextual Variability, referring to the difference in *emotional intensity* between alert^x and alert^{x+1}.

(c) Adaptability: a new variable was created to represent adaptability as the average success in achieving goals (either *decrease, increase emotion, or achieve something*).

Method 1: Week-level

Context variability. In order to compute an External Contextual Variability index, we first created a variable coded as 0 when there is no change in any of the context variables from one alert to the other, and 1 if there is a change in at least one of the context variables. Then, the total amount of changes in context per participant per week was calculated and divided by the number of alerts per participant (i.e., three values per participant) and served as a continuous External Contextual Variability index. Mean Internal Contextual Variability scores were computed using the Root Mean Square of Successive Differences (RMSSD - '*relativeVariability*' package - Mestdagh et al., 2018) in emotional intensity (i.e., three values per participant) and served as a continuous Internal Contextual Variability index.

Strategy variability. The RMSSD (see Wenzel et al., 2021) was computed to illustrate differences in strategy-use between two alerts, using the '*relativeVariability*' package. This value is obtained by first calculating each successive intensity of strategy-use difference between alerts. Each value is then squared, and the result is averaged before the square root of

the total is obtained. The RMSSD thus reflects the alert-to-alert variance in strategy-use and summarises changes in a given strategy from one time point to the next resulting in a unique value per week. The average RMSSD across strategies was computed to represent the mean strategy variability during the week.

Model. As already mentioned, we considered the covariation between context-variability and strategy use-variability as an indicator of flexibility. To examine whether the ART moderated this covariation, we estimated two linear mixed-effects models with the RMSSD as a DV, Group (Relaxation coded -0.5; ART coded +0.5), Time (pre-intervention coded -0.5; post-intervention coded +0.5), and External or Internal Contextual Variability (depending on the estimated model) and their interaction terms as fixed-factors as well as participants as random factor.

$$\text{RMSSD} \sim \text{Time*Group*External Contextual Variability}+(1|\text{Participant})$$

$$\text{RMSSD} \sim \text{Time*Group*Internal Contextual Variability}+(1|\text{Participant})$$

To test whether variability in the use of strategies at the week level influences adaptability, we first calculated the average success in achieving goals and used it as a DV in the following model.

$$\text{Adaptability} \sim \text{Time*Group*RMSSD}+(1|\text{Participant})$$

Method 2: Alert-level

Context variability. First, lagged variables for each context variable were created. Then, External Contextual Variability was coded as -0.5 (no change in any of the context variable from one alert to the other) or +0.5 (change in any of the context variables from one alert to the other). A lagged variable was created for emotional intensity to calculate the absolute difference between alert^x and alert^{x+1}, representing continuous Internal Contextual Variability.

Strategy variability. For the index of variability in the use of strategy, lagged variables were created for each strategy to calculate the absolute difference in strategy-use between alert^x and alert^{x+1}. These difference scores were averaged to obtain a mean strategy variability score across strategies per alert.

Model. For this method again, we considered the covariation between context-variability and strategy use-variability as an indicator of flexibility. To examine whether the ART moderated this covariation, we estimated two linear mixed-effects models with the mean strategy variability score as DV, Group (Relaxation coded -0.5; ART coded +0.5), Time (pre-intervention coded -0.5; post-intervention coded +0.5), and External or Internal Contextual Variability (depending on the estimated model) and their interaction terms as fixed-factors as well as participants as random factor. Considering the multiple measurements per participant, we acknowledge that we could have included the External Contextual Variability by participants as a random factor. However, due to the small current sample size, the model would have been too complex. This random effect being not significant (comparison between the two models – including or not the random effect of External Contextual Variability by participant – $\chi^2(2) = 4.93, p = .08$), we did not include it in the model.

Mean strategy variability ~ Time*Group*External Contextual Variability(1|Participant)

Mean strategy variability ~ Time*Group*Internal Contextual Variability(1|Participant)

To test whether variability in the use of strategies at the alert level influences adaptability, we first calculated the average success in achieving goals at each alert to test the following model.

Adaptability ~ Time*Group*Mean strategy variability +(1|Participant)

See Figure 2 & Figure 3 for an illustration of the methods.

Figure 2

Illustration of strategy-variability operationalisations

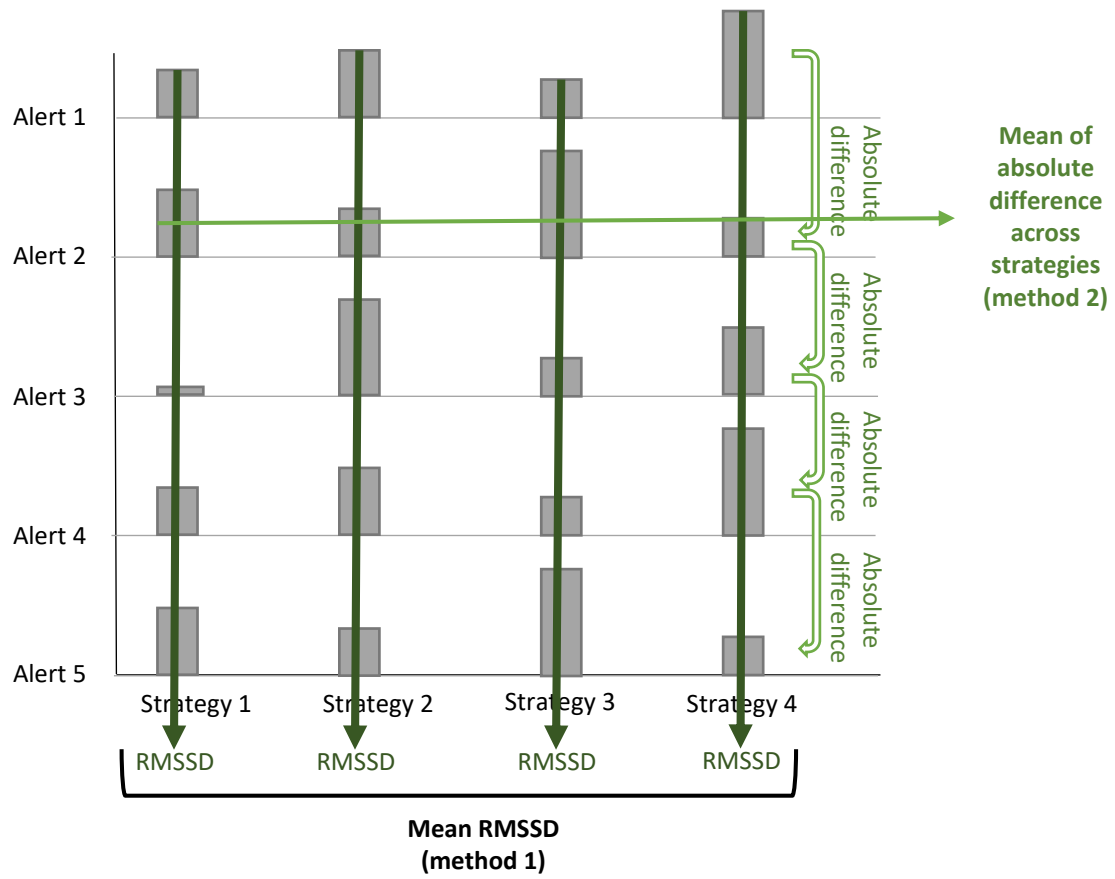
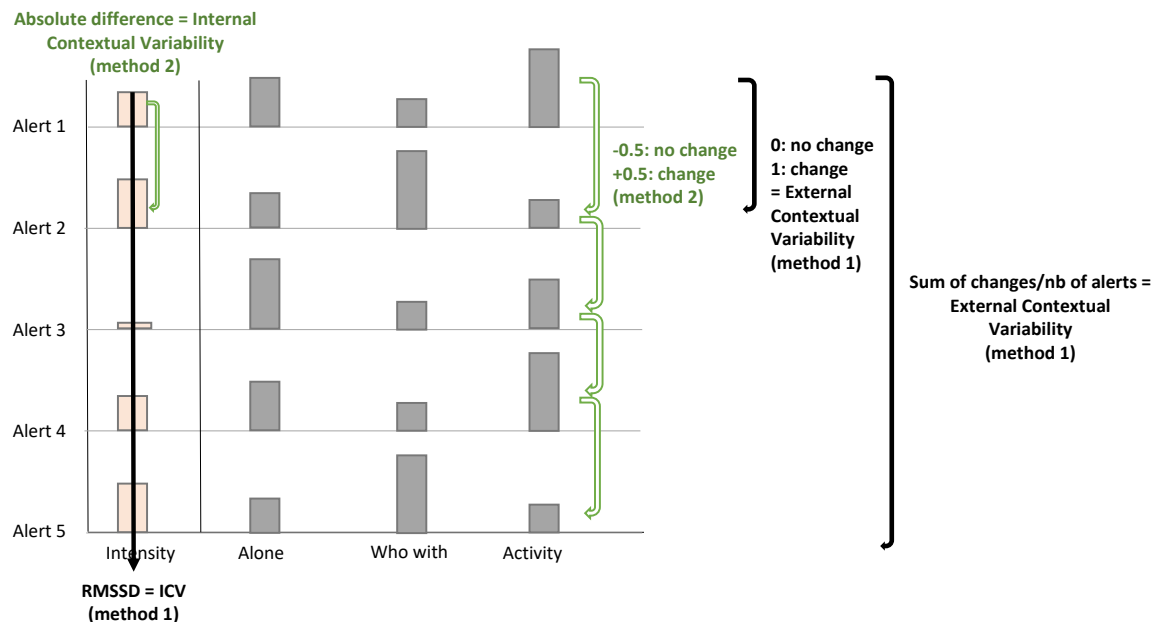


Figure 3*Illustration of context-variability operationalisation*

Results

Descriptive data

Among the 27 participants that have been included in the two groups so far, one participant did not complete the T2 of ESM and one participant only completed one alert of the T1 ESM. Thus, these two participants were excluded from the analysis related to the ESM but included in the analyses of pre- and post-measures. The sample for pre- and post-measures only was composed of 27 participants and the sample for the ESM analyses was composed of 25 participants. Most of our sample reported no psychiatric treatment (88.9%), or psychological treatment (81.5%) at pre-intervention, and 98.1% reported no change in treatments during the interventions. Further details on descriptive data are provided in Table 3.

Descriptive data of ESM showed that at T1 participants answered on average 15 alerts out of 35, 15 at T2 and 11 at T3. The mean strategy-use and mean emotional intensity per Group and per Time are available in Supplementary material.

Table 3*Descriptive data*

Variable	Total sample (N = 27)	ART (N = 15)	RELAX (N = 12)
Age (years ± SD)	22.1 ± 3.12	21.7 ± 2.38	22.8 ± 3.89
Gender (n [%])			
Female	22 [81.5]	12 [80]	10 [83.3]
Male	5 [18.5]	3 [20]	2 [16.7]
Questionnaires pre-intervention M ± SD	ART	RELAX	
BDI II – total score	16.7 ± 7.32	13.4 ± 7.62	
BAI – total score	16.5 ± 8.92	12.8 ± 8.34	
ERSQ – total score	50.7 ± 14.8	62.7 ± 14.5	
ERSQ – Understanding	5.47 ± 2.70	6.92 ± 3.06	
ERSQ – Awareness	5.60 ± 2.20	7.83 ± 1.95	
ERSQ – Clarity	6.07 ± 2.84	7.42 ± 3.06	
ERSQ – Sensations	6.07 ± 2.70	6.08 ± 2.11	
ERSQ – Tolerance	4.53 ± 2.29	6.50 ± 2.35	
ERSQ – Acceptance	4.87 ± 2.45	6.42 ± 1.51	
ERSQ – Self-support	5.20 ± 2.48	8.00 ± 2.00	
ERSQ – Modification	5.33 ± 2.53	6.58 ± 1.68	
ERSQ – Confrontation	7.20 ± 2.68	6.92 ± 3.03	
Questionnaires mid-intervention M ± SD	ART	RELAX	
CALPAS – total score	149 ± 10.3	140 ± 14.2	
CEQ – total score	40.8 ± 47.6	26.8 ± 7.71	

Questionnaires post-intervention M ± SD	ART	RELAX
BDI II – total score	6.13 ± 5.60	7.67 ± 4.79
BAI – total score	10.0 ± 8.35	9.33 ± 6.64
CALPAS – total score	144 ± 15.7	142 ± 13.9
ERSQ – total score	76.4 ± 10.8	69.7 ± 15.1
ERSQ – Understanding	8.33 ± 2.13	8.00 ± 2.86
ERSQ – Awareness	8.33 ± 2.13	8.00 ± 2.86
ERSQ – Clarity	9.40 ± 1.55	8.00 ± 2.37
ERSQ – Sensations	8.73 ± 2.40	8.25 ± 2.05
ERSQ – Tolerance	8.20 ± 2.11	7.00 ± 2.30
ERSQ – Acceptance	7.93 ± 1.49	6.17 ± 3.19
ERSQ – Self-support	8.27 ± 2.05	8.83 ± 1.95
ERSQ – Modification	7.67 ± 1.88	6.83 ± 2.08
ERSQ – Confrontation	9.00 ± 2.04	8.75 ± 2.99

Note. BDI II: Beck Depression Inventory; BAI: Beck Anxiety Inventory; CALPAS: California Psychotherapy Alliance Scale; CEQ: Credibility/Expectancy Questionnaire; ERSQ: Emotion Regulation Skills Questionnaire.

Control analyses

There were no significant differences between groups at pre-intervention for BDI II ($t(23.3) = 1.14, p = .27, d = .44$), BAI ($t(24.3) = 1.09, p = .29, d = .42$), and ERSQ ($t(23.9) = -2.11, p = .06, d = .82$). There were no significant differences in CALPAS at mid-intervention ($t(19.5) = 1.70, p = .11, d = .68$) nor at post-intervention ($t(19.5) = 1.70, p = .11, d = .15$). Similarly, there was no difference in CEQ at mid-intervention between groups ($t(14.9) = 1.12, p = .28, d = .39$) (see Table 3 for mean values).

Effect of time and group on mental health (questionnaires pre- and post-intervention)

The analysis revealed a significant main effect of Time on BDI ($t(25) = -5.33, d = -2.13, b = -8.17, p < .001, 95\% \text{ CI } [-11.26, -5.09]$), BAI ($t(25) = -3.58, d = -1.43, b = -4.98, p = .001, 95\% \text{ CI } [-7.78, -2.18]$) and ERSQ total score ($t(25) = 4.65, d = 1.86, b = 16.33, p < .001, 95\% \text{ CI } [9.27, 23.40]$). This indicates a decrease in anxious and depressive symptoms and an increase

in ER skills after the interventions. Moreover, contrary to our prediction, the interaction between Group and Time was not significant for BDI ($b = -4.85, p = .121, 95\% \text{ CI } [-11.02, 1.32]$), BAI ($b = -2.97, p = .29, 95\% \text{ CI } [-8.57, 2.63]$), but significant for ERSQ total score ($b = 18.67, p = .01, 95\% \text{ CI } [4.53, 32.80]$). This means that the changes in BDI, BAI are not different between groups but changes in ERSQ are greater in the ART than in the Relaxation group (see Table 4 & Figure 4).

Considering the ERSQ subdimensions, the main effect of Time was significant for all dimensions, which suggests an improvement in all skills after the interventions. In contrast, the interaction effect Time*Group was significant for Awareness ($b = 3.27, p < .001, 95\% \text{ CI } [1.63, 4.91]$), Tolerance ($b = 3.17, p = .01, 95\% \text{ CI } [0.93, 5.40]$), Acceptance ($b = 3.32, p = .01, 95\% \text{ CI } [0.97, 6.66]$), and Clarity ($b = 2.75, p = .03, 95\% \text{ CI } [0.36, 5.14]$), and tendential for Self-support ($p = .06$) and Modification ($p = .06$) (see Table 4 & Supplementary material). This means that the ART leads to a greater increase in those skills as compared to the control group.

Table 4*Mixed models for main outcomes (i.e., BDI II, BAI, ERSQ)*

BDI II – Total score						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau00$	ICC	R^2/Ω^2
<i>(Intercept)</i>	10.99	9.00 – 12.97	< .001	31.40, 10.25	0.25	0.323/0.489
<i>Time</i>	-8.17	-11.26 - -5.09	< .001			
<i>Time*Group</i>	-4.85	-11.02 – 1.32	.121			
BAI – Total score						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	12.16	9.30 – 15.02	< .001	25.85, 40.95	0.61	0.112/0.657
<i>Time</i>	-4.98	-7.78 - -2.18	.001			
<i>Time*Group</i>	-2.97	-8.57 – 2.63	.292			
ERSQ – Total score						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	64.87	60.83 – 68.91	< .001	164.67, 25.41	0.13	0.346/0.433
<i>Time</i>	16.33	9.27 – 23.40	< .001			
<i>Time*Group</i>	18.67	4.53 – 32.80	.011			
ERSQ – Understanding						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	7.18	6.38 – 7.98	< .001	5.89, 1.27	0.18	0.161/0.309
<i>Time</i>	1.97	0.64 – 3.31	.005			
<i>Time*Group</i>	1.78	-0.89 – 4.46	.186			
ERSQ – Awareness						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	7.53	6.95 – 8.11	< .001	2.22, 1.11	0.33	0.324/0.550
<i>Time</i>	1.63	0.81 – 2.45	< .001			
<i>Time*Group</i>	3.27	1.63 – 4.91	< .001			
ERSQ – Clarity						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	7.72	6.96 – 8.49	< .001	4.73, 1.50	0.24	0.205/0.397
<i>Time</i>	1.96	0.76 – 3.16	.002			
<i>Time*Group</i>	2.75	0.36 – 5.14	.025			
ERSQ – Sensations						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	7.38	6.73 – 8.03	< .001	5.56, 0.00	0.00	0.190/0.190
<i>Time</i>	2.22	0.92 – 3.51	.001			
<i>Time*Group</i>	0.10	-2.50 – 2.70	.939			
ERSQ – Tolerance						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	6.56	5.88 – 7.24	< .001	4.13, 0.98	0.19	0.278/0.416
<i>Time</i>	2.08	0.96 – 3.20	< .001			
<i>Time*Group</i>	3.17	0.93 – 5.40	.006			
ERSQ – Acceptance						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	6.35	5.70 – 6.99	< .001	4.54, 0.48	0.10	0.211/0.286
<i>Time</i>	1.41	0.23 – 2.58	.020			
<i>Time*Group</i>	3.43	0.71 – 6.16	.015			
ERSQ – Self-support						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	7.58	6.98 – 8.17	< .001	4.53, 0.09	0.02	0.315/0.328
<i>Time</i>	1.95	0.78 – 3.12	.002			
<i>Time*Group</i>	2.23	-0.11 – 4.58	.061			

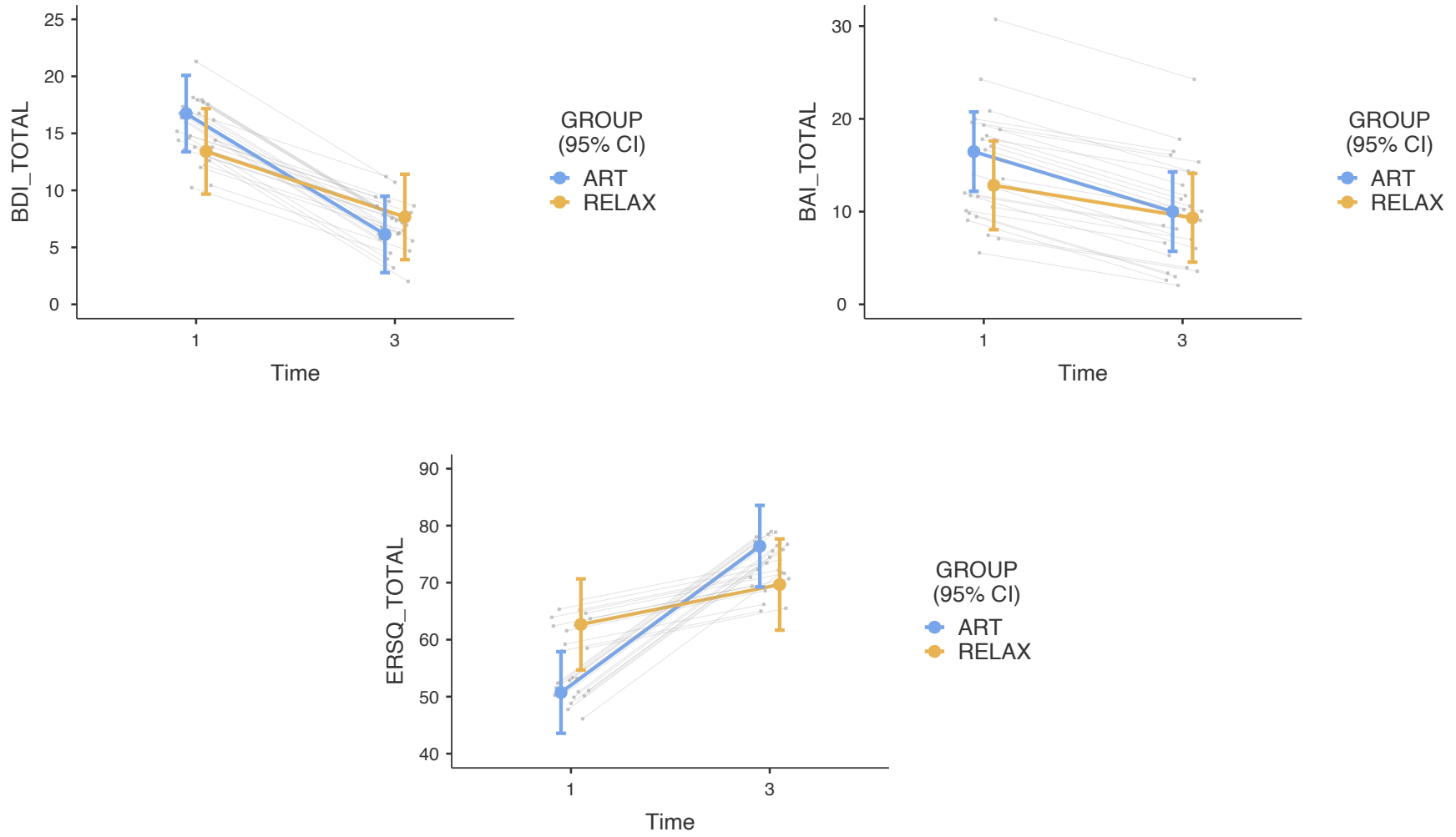
ERSQ – Modification						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	6.60	6.00 – 7.21	< . 001	3.83, 0.51	0.12	0.154/0.254
<i>Time</i>	1.29	0.21 – 2.37	.020			
<i>Time*Group</i>	2.08	-0.07 – 4.24	.058			
ERSQ – Confrontation						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	7.97	7.08 – 8.85	< . 001	4.00, 3.15	0.44	0.107/0.500
<i>Time</i>	1.82	0.72 – 2.92	.002			
<i>Time*Group</i>	-0.03	-2.24 – 2.17	.976			

Note. σ^2 : within-person residual variance; $\tau00$: between-person variance; *ICC*: Intra-class correlation,

proportion of variance explained by between-person differences. R^2/Ω^2 : variance of fixed effects/variance of both fixed and random effects.

Figure 4

*Effect of Time, Group, and Time*Group on mental health outcomes*



Effect of Time and Group on flexibility (ESM data)

Method 1: As detailed previously, we tested the effect of intervention efficacy on flexibility by operationalising flexibility in terms of covariation between context variability (internal and external) and the mean variability in the use of strategies during the week (i.e., RMSSD). For the model considering Internal Contextual Variability, the results revealed a main effect of Time ($b = -.07, p < .01, 95\% \text{ CI } [-0.11, -0.04]$). This indicates that the overall strategy-variability decreased after the interventions. We also obtained an effect of Internal Contextual Variability ($b = .38, p < .001, 95\% \text{ CI } [0.20, 0.56]$), indicating that the higher was the mean change in emotional intensity during the week, the more overall strategy-variability increased (See Table 5). As revealed by a significant Time*Internal Contextual Variability interaction, this effect is reduced after the intervention ($b = -.37, p = .02, 95\% \text{ CI } [-0.67, -0.07]$). The predicted Time*Group*Internal Contextual Variability was not significant ($b = .06, p = .84, 95\% \text{ CI } [-0.54, -0.66]$). Said otherwise, both interventions reduced flexibility (conceived as the covariations between contextual-variability and variability in the use of strategies at the week level), but no more for the ART than for the Relaxation group. For the model considering External Contextual Variability, results only revealed a main effect of Time, such that the overall strategy-variability decreased after the interventions ($b = -.06, p < .01, 95\% \text{ CI } [-0.10, -0.02]$).

Table 5

Method 1: Mean strategy variability with Time, Group, and External and Internal Contextual Variability as predictors

Mean strategy variability RMSSD						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau 00$	ICC	R^2/Ω^2
<i>(Intercept)</i>	0.47	0.43 – 0.51	< .001	0.00, 0.01	0.64	0.083/0.674
<i>Time</i>	-0.06	-0.10 - -0.02	.003			
<i>Time*Group</i>	-0.02	-0.10 – 0.07	.687			
<i>External Contextual Variability</i>	0.04	-0.10 – 0.07	.573			
<i>External contextual Variability*Time</i>	-0.05	-0.24 - 0.14	.614			
<i>Time*Group*External Contextual Variability</i>	-0.06	-0.44 – 0.32	.752			
Mean strategy variability RMSSD						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau 00$	ICC	R^2/Ω^2
<i>(Intercept)</i>	0.47	0.42 – 0.51	< .001	0.00, 0.01	0.78	0.197/0.820
<i>Time</i>	-0.07	-0.11 - -0.04	< .001			
<i>Time*Group</i>	0.02	-0.05 – 0.09	.538			
<i>Internal Contextual Variability</i>	0.38	0.20 – 0.56	< .001			
<i>Internal Contextual Variability*Time</i>	-0.37	-0.67 - -0.07	.016			
<i>Time*Group*Internal Contextual Variability</i>	0.06	-0.54 – 0.66	.843			

Note. RMSSD: Root Mean Square of Successive Differences (mean across all strategies).

Concerning adaptability, that is success in achieving goals due to variability, the analyses revealed a main effect of Time ($b = .14, p < .01, 95\% \text{ CI } [0.06, 0.23]$). Participants were more successful in achieving their goals after the interventions than before. Analyses also revealed a main effect of RMSSD ($b = .64, p < .01, 95\% \text{ CI } [0.24, 1.04]$), that is, participants achieve their goals more with higher variability in the use of strategy at the week-level. No other effect was significant, including the expected Time*Group*RMSSD (See Table 6). Thus, contrary to our prediction, the two interventions did not moderate the influence of strategy-variability on goal success; that is, the ART was not superior to the control group in enhancing adaptability at the week-level.

Table 6

Method 1: Goal success with Time, Group, and RMSSD as predictors

	Goal success					
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau00$	ICC	R^2/Ω^2
<i>(Intercept)</i>	0.47	0.42 – 0.52	< . 001	0.02, 0.01	0.31	0.316/0.529
<i>Time</i>	0.14	0.06 – 0.23	.001			
<i>Time*Group</i>	-0.03	-0.20 – 0.14	.737			
<i>RMSSD</i>	0.64	0.24 – 1.04	.002			
<i>RMSSD*Time</i>	0.50	-0.27 - 1.28	.201			
<i>Time*Group*RMSSD</i>	-0.57	-2.34 – 1.20	.519			

Note. RMSSD: Root Mean Square of Successive Differences.

Method 2 included a second set of models with the mean strategy variability at the alert-level as the outcome. Concerning the model including External Contextual Variability, the main effect of Time was significant ($b = -.07, p = .02, 95\% \text{ CI } [-0.12, -0.01]$): after the interventions, participants manifested less variability in the use of strategy at the alert-level. The analyses also revealed a main effect of External Contextual Variability ($b = .06, p = .01, 95\% \text{ CI } [0.02, 0.10]$) (see Table 7). This indicates that the more there is variability in external context, the more participants are variable in their use of strategies from one alert to the other. The interaction

effect Time*External Contextual Variability was significant ($b = .11, p = .048, 95\% \text{ CI } [0.00, 0.23]$), which indicates that the effect of External Contextual Variability on strategy-variability increased over time. However, the expected Time*Group*External Contextual Variability was not significant ($b = .11, p = .35, 95\% \text{ CI } [-0.12, -0.33]$). Said otherwise, both groups seem to have increased the influence of External Contextual Variability on strategy-variability at the alert-level, and thus participants' flexibility, with no superiority for the ART. Concerning the model including Internal Contextual Variability, only the main effect of Internal Contextual Variability was significant ($b = .11, p < .001, 95\% \text{ CI } [0.07, 0.16]$), which indicates that the more variability in internal context, the more participants are variable in their use of strategies from one alert to the other.

Table 7

Method 2: Mean strategy variability with Time, Group, and External and Internal Contextual Variability as predictors

Mean strategy variability						
	Estimates	95% CI	<i>p</i> value	σ^2, τ^2	ICC	R^2/Ω^2
<i>(Intercept)</i>	0.24	0.21 – 0.27	< .001	0.01, 0.00	0.26	0.017/0.277
<i>Time</i>	-0.07	-0.12 – -0.01	.017			
<i>Time*Group</i>	-0.04	-0.15 – 0.07	.470			
<i>External Contextual Variability</i>	0.06	0.02 – 0.10	.006			
<i>External Contextual Variability*Time</i>	0.11	0.00 - 0.23	.048			
<i>Time*Group*External Contextual Variability</i>	0.11	-0.12 – 0.33	.353			
Mean strategy variability						
	Estimates	95% CI	<i>p</i> value	σ^2, τ^2	ICC	R^2/Ω^2
<i>(Intercept)</i>	0.26	0.24 – 0.29	< .001	0.01, 0.00	0.28	0.040/0.307
<i>Time</i>	-0.02	-0.03 – 0.00	.097			
<i>Time*Group</i>	-0.01	-0.04 – 0.03	.757			
<i>Internal Contextual Variability</i>	0.11	0.07 – 0.16	< .001			
<i>Internal Contextual Variability*Time</i>	0.01	-0.10 - 0.12	.833			
<i>Time*Group*Internal Contextual Variability</i>	0.03	-0.19 – 0.25	.808			

Concerning adaptability, again, considered as success in achieving goals due to variability at the alert-level, the analyses revealed a main effect of Time ($b = .08, p = .02, 95\%$ CI [0.01, 0.14]). This means that participants achieve more their goals after the interventions than before. We also obtained a main effect of mean strategy-variability ($b = .32, p = .02, 95\%$ CI [0.05, 0.60]). That is, the more participants manifested variability in their use of strategies at the alert-level, the more they succeeded in achieving their goals. No other effect emerged, including the expected Time*Group*Mean strategy variability ($b = .62, p = .35, 95\%$ CI [-0.69, 1.94]) (see Table 8). Thus, contrary to our prediction, the ART was not superior to the control group in enhancing goal success at the alert-level.

Table 8

Method 2: Goal success with Time, Group, and Mean strategy variability as predictors

	Goal success			σ^2, τ_{00}	ICC	R^2/Ω^2
	Estimates	95% CI	p value			
<i>(Intercept)</i>	0.46	0.42 – 0.50	< .001	0.06,	0.07	0.099/0.166
<i>Time</i>	0.08	0.01 – 0.14	.018	0.00		
<i>Time*Group</i>	0.02	-0.10 – 0.15	.734			
<i>Mean strategy variability</i>	0.32	0.05 – 0.60	.022			
<i>Mean strategy variability*Time</i>	0.01	-0.65 - 0.67	.973			
<i>Time*Group*Mean strategy variability</i>	0.62	-0.69 – 1.94	.352			

Table 9 summarises the results of the two methods that we used to test our hypotheses. Although these results are exploratory, both methods indicate that greater Internal Contextual Variability predicts greater variability in strategy-use (whether at the week or alert level). However, only method 2 suggests that greater External Contextual Variability also predicts higher variability in strategy-use. Time is predictive of decreased variability in strategy-use in both methods. None of the models supports an influence of the group. Finally, the two methods

indicate that Time predicts higher goal achievement and that higher variability in strategy-use predicts greater goal success.

Table 9

Comparisons between methods 1 and 2

Outcome	Method 1	Method 2
Mean strategy variability	Time (-) Internal Contextual Variability (+)	Time (-) External Contextual Variability (+) Internal Contextual Variability (+)
Goal success	Time (+) RMSSD (+)	Time (+) Mean strategy variability (+)

Note. (+) and (-) represent the positive or negative coefficient.

The mediating role of flexibility

We hypothesised that flexibility mediated the effect of intervention on health outcomes. We considered the covariation between context-variability and variability in the use of strategies as an index of flexibility. To test such a mediation hypothesis would have required to obtain the effect of context-variability on strategy-use variability for each participant and to consider the corresponding coefficients as the mediator. However, as already mentioned, the sample size is too small to estimate these parameters with confidence, as it would complexify the random factor structure. Consequently, in the current state of data collection, we cannot test our mediation hypothesis.

Exploratory analyses using within-strategy variability

In the previous sections, we investigated the effect of interventions on flexibility by considering the covariations between contextual-variability and the mean variability across strategies, without distinguishing strategy-specific variability. In this section, we conducted exploratory analyses to test the effect of intervention on flexibility by considering the relation

between context-variability and variability in the use of each strategy (i.e., within-strategy variability). For these analyses also, we applied both Method 1 (i.e., mean strategy variability at the week-level with RMSSD) and Method 2 (i.e., absolute difference in the use of strategy from one alert to the other) to obtain a variability index in the use of each strategy. The interested reader can read Supplementary material for the details of these analyses, which are summarised below.

Using Method 1, the main effect of Time predicted specific strategy's decreased variability (i.e., self-support, relaxation, acceptance, avoidance, consumption). Using Method 2, the effect of Time predicted decreased variability in Self-support, Consumption, Problem-solving, Tolerance, Acceptance, Rumination, and Avoidance, and increased variability in Relaxation and Expression. The interaction Time*Group was only significant and negative for Problem-solving variability and positive Suppression variability in Method 1.

In Method 1, specific within-strategy variabilities were predicted by External Contextual Variability (e.g., Consumption, Avoidance) and Internal Contextual Variability (e.g., Reappraisal, Distraction, Acceptance). In Method 2, External Contextual Variability predicted increased variability in Relaxation, Problem-solving, Acceptance; Internal Contextual Variability predicted increased variability for specific strategies (e.g., Reappraisal, Distraction, Social support).

The interaction Time*Group*External Contextual Variability was significant and positive for Reappraisal and negative for Tolerance, only in Method 1. The interaction Time*Group*Internal Contextual Variability was not significant whatever the method used.

Discussion

The main aim of this study was to test the efficacy of the ART on mental health outcomes (i.e., anxious and depressive symptoms and ER skills). A secondary goal was to test

the potential mediating role of ER flexibility. Considering the ongoing recruitment process, we acknowledge that these findings are exploratory and should be interpreted with caution. Accordingly, this discussion section will suggest some directions of interpretation before having the results on the complete sample.

Efficacy of the ART in improving mental health and ER skills

Our preliminary findings suggest that the ART program is as effective as our active control group in improving depressive and anxious symptoms. Considering previous studies showing relaxation interventions to have an impact on such symptoms (Francesco et al., 2010; Jia et al., 2020; Kim & Kim, 2018; Kische et al., 2022; Manzoni et al., 2008), our findings are consistent with our hypothesis expecting ART to have *at least* the same impact on symptoms.

This is in agreement with previous studies showing the ART improves anxiety and depression (Berking et al., 2008, 2013; Lotfi et al., 2020). The absence of difference between groups on depressive symptoms corroborates Berking et al.'s findings (2019), showing no superiority of the ART over a common-factors control condition. Indeed, their control condition and ours share similar factors, such as therapeutic alliance and activation of patients' resources. Overall, the ART seems to be effective in decreasing depressive symptoms. Concerning anxious symptoms, studies investigating the efficacy of the ART on this outcome are scarce (e.g., Berking et al., 2019; Lotfi et al., 2020) but seem to indicate no difference between groups when using an active control condition (Berking et al., 2019). Thus, our results would benefit from replication studies using active controls to explore whether the ART holds superiority in improving anxiety.

Similarly, both groups seem to have improved in ER skills over time, which supports other studies showing the efficacy of the ART in enhancing those skills (Berking et al., 2008, 2010, 2019) and studies showing that various treatments improve ER (Sloan et al., 2017). The

significant interaction suggests a larger increase in the ART group, in line with previous studies (e.g., Berking et al., 2019). Considering that our recruitment is still in process, replicating those analyses on the final sample will provide further information on the specific influence of the ART on ER skills.

Still, when taking a closer look at the ERSQ, our preliminary analyses revealed a discrepancy between skills, highlighting the superiority of the ART for Awareness, Tolerance, Acceptance, and Clarity. The absence of difference between groups for the other skills suggests that their improvement may be fostered by common processes underlying the two groups. Understanding may have been, for instance, increased by the psychoeducation session similar in the two groups. Precisely, the dissemination of information surrounding emotional processes might have empowered and triggered participants' ability to identify the causes and consequences of their emotions (Shah et al., 2014; Van Daele et al., 2012). Moreover, participating in such RCT, even in the Relaxation group, may have expanded participants' tendency to observe and analyse their emotional experiences spontaneously. The ESM might have further impacted our participants' behaviours. Upon asking them to recall their context, emotional experience, and regulation several times per day, our protocol has probably enhanced their ability to identify, label, and understand their emotions. Indeed, despite its assessment use in our study, the ESM may have had an impact on their functioning. For example, studies have identified that self-monitoring can contribute to reducing depressive symptoms (Dimidjian et al., 2006), leading ESM to be considered as a potential therapeutic tool (Kramer et al., 2014).

Likewise, Self-support may have been fostered in the Relaxation group by enhancing self-compassion through the practice of techniques aiming at reducing distress in difficult emotional experiences and through the factors related to engaging in psychological intervention. By teaching individuals to apply relaxation, we provide them with new tools to regulate their emotions. As such, it might increase their ability to Confront situations, being

empowered by these techniques to apply in case of need. Furthermore, and in line with our hypothesis, the Sensations dimension was enhanced in both groups, supporting the fact that Relaxation also improves the ability to turn one's attention towards bodily sensations (e.g., '*I had a clear physical perception of my feelings*').

Our most surprising result concerns the absence of difference between groups for the Modification dimension. However, one possible explanation lies in the way the ERSQ assesses this skill (three items, e.g., '*I was able to influence my negative feelings*'). These general items provide a restrictive view of the ability to modify emotions compared to the number of related abilities the ART implies. Hence, participants from the Relaxation group may have, in fact, raised their ability to *influence their negative feelings* thanks to relaxation practices.

In contrast, the interaction between Time and Group was significant for Awareness, Tolerance, Acceptance, and Clarity. This denotes the specificity of the ART to enhance the three skills. While Relaxation can give cues to participants on how to act on their emotional experiences, the ART further teaches participants to be aware, clear, tolerant, and accept their emotions.

A preliminary attempt to operationalise flexibility

Whether measured on average per week or more dynamically per alert, our findings suggest an influence of both groups on mean strategy-variability. That is, both nine-session interventions seem to foster a more stable use of ER strategies. At first glance, this pits against previous findings showing that more variability in strategy-use is associated with better mental health (e.g., Blanke et al., 2020) but also aligns with more recent findings showing negative consequences of variability (e.g., Elkjaer et al., 2022). In our case, the interventions seem to have increased mental health while concurrently having decreased mean strategy variability. That is, having a stable pattern of ER strategy use may be beneficial and possibly reflect

adaptive stable reliance on strategies leading to successful ER, thus improving mental health, in contrast to high variability that could represent extreme fluctuations in strategy use leading to unsuccessful ER (Blanke et al., 2019).

However, considering all strategies together to compute a mean strategy variability index may be reductive to the extent that different strategies may vary differently, and may be differently influenced by contextual changes. Accordingly, we argue that future studies should focus on within-strategy variability. For example, our exploratory analyses per specific strategy (i.e., within-strategy variability) suggest a difference between specific strategies. While most variability decreased over time (e.g., Self-support, Acceptance, Avoidance, Consumption in both methods) leading to a more stable use of these strategies, variability in the use of Expression and Relaxation variabilities seem to increase over time (Method 2).

Despite the exploratory nature of these results, this kind of analysis can represent the opportunity to clarify the distinction between strategies and skills and to highlight a significant limitation of this study. Indeed, several 'strategies' measured in our ESM protocol can be considered as skills (e.g., ACE model), less likely to vary on a daily basis. Their decreased variability in time could corroborate instead a general tendency of increased or decreased (and more stable) use of those skills (e.g., increase in acceptance use, decrease in avoidance use). Considering that participants improved in ER skills, it seems plausible that they did use skills in a more stable manner (e.g., Self-support, Acceptance, Problem-solving). Likewise, the ART fosters approach behaviours and can thus diminish the overall use of avoidance. In contrast, the variability of specific strategies, more sensitive to contextual changes, would be likely to increase. This hypothesis is congruent with our exploratory findings showing that Suppression variability increases, and specifically in the ART group. In sum, these findings (if replicated) would add further evidence of the stability of skills, in contrast to the adaptive variability in strategies, such as emotional expression. Nonetheless, an alternative explanation for the

decrease in mean strategy-variability in both groups could also be related to the burden associated with our ESM protocol; it is possible that participants displayed more careless responses in time, that is, entering the same pattern of responses at each alert to finish the questionnaire quickly.

These findings also contribute to the debate on the adaptability of variability. Indeed, studies have shown that too much variability can be maladaptive (e.g., Gruber et al., 2013), possibly explained by unsuccessful attempts to regulate (Elkjaer et al., 2022). Recent studies rather emphasise the search for an optimal level of variability (Blanke et al., 2020), in which not enough variability reflects inflexibility while too much variability reflects instability (Houben et al., 2015). For example, Elkjaer et al. (2022) found that both within- and between-strategy variability were associated with higher negative affect and less satisfaction in life. In turn, Battaglini et al. (2022) found that within-strategy variability did not predict negative affect.

Beyond variability, we tried to operationalise flexibility by testing the influence of context (external and internal) on our variability indicators. However, discrepancies emerged between the two methods used. We believe it points towards the difference and, therefore, the importance of measuring dynamic processes at a moment-level, rather than through averaging procedures. Indeed, considering External Contextual Variability as a mean across all alerts leads to a unique value that is highly questionable, given the lack of information it represents. Still, this gave us the opportunity to compare the patterns emerging from the two methods. Alert-level External Contextual Variability predicting greater variability aligns with previous studies showing that contextual changes influence changes in strategies (e.g., Benson et al., 2019). Moreover, our results (alert-level) suggest that both interventions seem to have fostered the influence of External Contextual Variability on strategy-variability. That is, both groups may have helped individuals to better assess the context and choose strategies accordingly. Still,

one major limitation of the current operationalisation of external context is the use of an average value representing the change in several categorical variables. Thus, future studies are encouraged to preserve the specificity of each contextual characteristic.

In turn, emotional intensity as internal context seems to influence a more systematic increase in strategy-variability: both at the alert- and week-level, increased variability in emotional intensity was associated with increased mean strategy-variability. This is in line with Battaglini et al.'s results (2022) showing an influence of the interaction between environmental change and between-strategy variability on negative affect only when contextual change was indexed in terms of stressfulness difference (and not when indexed in terms of change in categorical contextual features). However, only Method 1 suggests that both interventions may have decreased the influence of Internal Contextual Variability on strategy-variability. Again, this preliminary result could be explained by a more stable use of strategies, thus becoming less sensitive to emotional intensity variability after the interventions.

Taken together, this line of research suggests that different weights could be attributed to different contextual features, such that internal context (i.e., emotional intensity) seems to have a more consistent impact on strategy-variability, using both methods (alert- or week-level). This is congruent with emotional intensity being at the core of ER processes, given that ER goals involve to decrease, maintain, or increase the emotional intensity. Concurrently, clinical interventions could lead to a change in patterns of ER variability, by fostering stability in skills, possibly less context-sensitive, and adaptive variability in specific strategies that are to be adapted to the changing context. However, those results are preliminary and lack power to reach more strong conclusions.

Adaptability

Our findings suggest that participants from both groups improved in achieving their goals after the interventions. Moreover, mean strategy variability at both week- and alert-level predicted higher goal success. This highlights the diverging operationalisations of adaptability in studies. Specifically, most studies interested in variability have explored its influence on negative affect, showing a limited or negative impact of variability (e.g., Battaglini et al., 2022; Blanke et al., 2020). However, when considering goal's achievement as an outcome, it seems that variability does enhance adaptability (at least when considering short-term goals) and that concurrently, both groups increased goal success. In other words, even though variability can lead to poor outcomes in the short term (e.g., increased negative affect), it can simultaneously facilitate goal achievement, as distress tolerance can foster the achievement of personal goals. Still, the current preliminary analyses did not test the impact of both groups and strategy-variability on longer-term goals (e.g., *is my behaviour congruent with the kind of person I want to be?*), although short and long-term goals may be conflicting and lead to different patterns of results.

Limitations

First, the main limitation of the current study is the lack of power associated with the sample size. We thus acknowledge that all analyses and findings must be interpreted with the utmost caution before being replicated with the expected complete sample. Therefore, current analyses and findings must be understood as exploratory.

Second, our study suffered from an important number of dropouts and inclusion difficulties. Indeed, a nine-session program can be challenging to match schedules, especially for university students who have classes from 9 am to 6 pm from Monday to Friday. In response to this, studies have been adapting interventions both online and through the help of

smartphones app to facilitate access to psychological interventions. A recent study by Wittkamp et al. (2023) showed no differences between the ART group and an ER self-help condition in preventing transition to mental disorders. Thus, it seems to represent a promising pathway to develop, which can be specifically well suited for a young population.

Lastly, this RCT would have benefited from follow-up measures on all outcomes to ensure the stability of the participants' improvements. A recent review by Moore et al. (2022) found some evidence for long-lasting ER improvements, although limited by a considerable heterogeneity in the findings. Hence, in agreement with Moore et al.'s recommendation, future studies should systematically include follow-up assessments of at least 6 or 12 months to evaluate the long-term efficacy of ER programs.

Conclusion

Despite the limitations associated with this study, it is, to our knowledge, the first RCT to test the efficacy of the ART in a French population, in comparison to an active control group, and using daily measurement in an attempt to operationalise ER flexibility. Even though preliminary, these findings suggest that the ART is effective to improve anxious and depressive symptoms, as well as ER skills. Moreover, it has raised further concerns and open questions surrounding the measurement of ER variability and flexibility while emphasising the importance of equilibrium in flexibility, in line with the most recent research in the ER field.

CHAPTER 3 - CONCLUSION

This third chapter aimed at addressing interventions on emotion regulation and flexibility. We also addressed principal challenges associated with the hypothesis of flexibility as a mediator. The focus on the ART (Berking & Whitley, 2014) has led us to present

preliminary findings of a Randomised Controlled Trial (Study 5) to test its efficacy in a French population of university students. These exploratory analyses suggested that the ART is effective to reduce anxiety and depression, as well as to increase ER skills. We also have questioned the impact of the two interventions on ER variability and flexibility, leading us to an emphasis on (1) the distinction between strategies and skills, and (2) the importance of investigating a possible equilibrium in variability towards adaptability.

GENERAL DISCUSSION

This thesis sought to explore emotion regulation flexibility through theoretical, methodological, and clinical perspectives.

The objective of the first chapter was to depict the theoretical framework of ER and its evolution. It led us to describe the ER skills of the ACE model (Berking & Whitley, 2014) and to introduce the first study of this thesis, the French validation of the ERSQ (Study 1 - Nardelli et al., 2023). Overall, our findings supported the nine-skill structure of the ACE model and demonstrated the good properties of the French version of the scale.

The second chapter addressed the shift from the dual view on ER strategies (adaptive vs maladaptive) to the concept of ER flexibility by describing the most influential flexibility models and exploring the challenges related to its measurement, leading to Studies 2, 3, and 4. Our French validation of the CSI and FREE scale (Study 2 - Nardelli et al., in submission) supported their good psychometric properties and replicated the previous factorial structure of the FREE questionnaire (i.e., four-dimension structure) (Burton & Bonanno, 2016). The Systematic Review on ER flexibility measures (Study 3 - Nardelli et al., in submission) indicated that both experimental and daily measurements can provide valuable information to measure flexibility, depending on the process targeted. The experimental study on ER choice (Study 4 - Nardelli et al., 2023) gave further evidence of the influence of context (here, the emotional intensity of the stimulus) on ER choice.

The third chapter was dedicated to describing clinical interventions on ER, focusing on improving flexibility as a potential mediator of the efficacy of the ART (Berking & Whitley, 2014) on mental health. This chapter ended with the presentation of the RCT conducted during this thesis (Study 5 - Nardelli et al., in prep). Overall, our study suggested that the ART can be effective to improve mental health (i.e., anxious and depressive symptoms) and ER skills.

Moreover, it suggested that both groups decrease overall strategy-variability, pointing towards the distinction between skills and strategies in terms of variability. Likewise, our preliminary analyses highlight a disparate influence of external vs internal contextual variability, in relation to issues regarding their operationalisation. Taken together, these exploratory analyses draw attention to the discrepancies between per-participant analyses (using average indices of variability) and alert-to-alert variabilities.

To discuss our results with a larger perspective, this section will be divided into four parts, from theoretical and clinical implications to a limitation section, followed by perspectives, and ending with a general conclusion.

1. Theoretical and clinical implications

1.1. *A focus on prerequisite ER skills to be flexible*

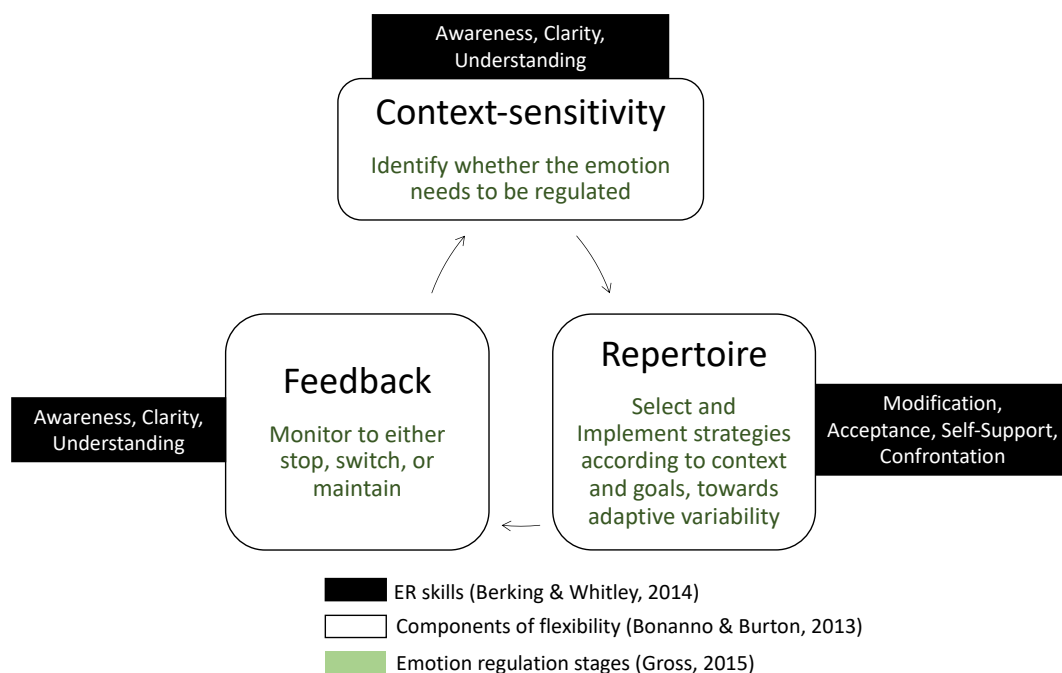
By providing a new measure of ER skills in the French population (i.e., ERSQ), Study 1 also contributed to add evidence for the ACE model (Berking & Whitley, 2014), which aligns with previous findings supporting the importance of ER skills in the ER process (Berking et al., 2019). Returning to our summary model on flexibility (Chapter 2), the current section attempts to integrate those skills along with previous models of ER and ER flexibility to propose an integrative understanding of the steps of ER flexibility.

Each step of the ER process described by Gross (2015), Aldao (2015) and Bonanno (2013) can be underpinned by ER skills for clinical purposes. As illustrated in Figure 1, to identify the need to regulate or not, one needs to be *aware* of their emotions, properly *identify* and *label* them, and *understand* their causes and consequences to better interpret contextual cues. These skills are also helpful to best understand the context/situation, considering that our

emotions influence (and are influenced by) the way we appraise the external context. Subsequently, it can also be helpful to best select and adjust strategies among the repertoire to contextual changes to demonstrate adaptive variability. The ability to *modify* the emotional experience through strategies can also directly be integrated into the repertoire (I have different strategies to deal with my emotions), which I can select (selection stage) and implement (implementation stage). This also applies to the *self-support* ability that can help individuals to *confront, tolerate, and accept* emotions that cannot be modified. Feedback (monitoring stage) implicates going back to the assessment of context and thus requires awareness of one's emotion again to ensure the need to maintain, stop, or switch regulation. From this perspective, all ER skills are valuable at all stages of the ER process, and instead of being regarded as an alternative ER model, it appears complementary. We accordingly adapted our summarising model to include examples of ER skills' influence (see Figure 1).

Figure 1

Summarising model including ER skills from the ACE model



Firstly, ER requires an initial evaluation of the emotional experience. To do so, the preliminary skills of *awareness*, *clarity*, and *understanding* are essential to guide what one should do to regulate emotions (Barrett & Gross, 2001). We showed preliminary evidence in favour of the influence of ER skills in ER choice, with awareness, acceptance, and tolerance dimensions of the ERSQ predicting decreased disengagement strategies (Study 4). Upon supporting the influence of such skills, a range of studies has shown that better awareness was related to increased effectiveness in ER (e.g., Barrett et al., 2001).

Emotion identification has also been studied in relation to interoceptive perception (Garfinkel et al., 2015; Herbert et al., 2011; Schuette et al., 2021), showing that poor identification of bodily signals was related to alexithymia (itself associated with various psychological difficulties; Günther et al., 2016). In a recent study (2023), Tan et al.'s results supported that interoceptive attention may increase awareness, which in turn can facilitate ER and flexibility. These results align with another study showing that internal feedback (including bodily information and awareness) guided people to switch strategies when the context changed (monitoring/feedback, Birk & Bonanno, 2016). While awareness is sometimes classified as a type of reappraisal (e.g., Webb et al., 2012), the ACE model instead considers this skill as a prerequisite to apply ER strategies better. Awareness is a first step towards regulation and is accordingly a core target in multiple psychological treatments (e.g., mindfulness practices; Roemer et al., 2015). Awareness can thus be understood as required to be sensitive to contextual cues and changes (i.e., monitoring) and best respond to situational demands. Moreover, combining the ability to be aware of one's emotion to the practice of tolerance and acceptance of the emotional experience could diminish avoidance (Blackledge & Hayes, 2001).

Properly identifying one's emotions also implies to correctly *label*, *name* them. Difficulties in emotional *clarity* (i.e., identifying which emotion one feels; Berking & Whitley, 2014) has been associated with multiple disorders (Harrison et al., 2010; Vine & Aldao, 2014).

Indeed, better differentiation between discrete emotions seems to facilitate ER (Barrett & Gross, 2001). It is worth mentioning that other studies suggest that correctly naming emotions is associated with diminished use of reappraisal and acceptance (e.g., Nook et al., 2021). However, it is possible that identifying one's emotions can lead to a decrease in specific strategy use in the short term (by worsening mood) but be beneficial in the longer term (Nook et al., 2021).

Discriminating emotions can also increase emotional *knowledge*²³, hence improving the ability to *understand*²⁴ especially the causes of the emotional experience (context-sensitivity). This agrees with a recent study showing that better source/causal attribution was associated with increased ER attempts and better well-being (Millgram et al., 2022). Consistently, Chen and Bonanno (2021) found that anxiety was particularly high in individuals reporting deficits in context-sensitivity (compared to deficits in repertoire and/or feedback). Taken together, current studies emphasise the primary importance of perceiving and assessing the antecedents of an emotional experience, and suggest that understanding could be considered as a skill strongly involved in better context-sensitivity.

Since increased awareness, clarity, and understanding of emotion can be associated with mood deterioration in the short term (Berking & Whitley, 2014), the *self-support* ability is of primary interest and can be implicated in multiple stages of the ER process to enhance ER flexibility. Indeed, self-compassion²⁵ has been evidenced to act on depression via ER (Krieger et al., 2013; Neff, 2003). Moreover, the habitual use of self-compassion seems to impact mental health by facilitating adaptive ER (for a meta-analytic review, see Inwood & Ferrari, 2018), which supports ER as a potential mediator in the relationship between compassion and mental

²³ Concept used in the emotional intelligence literature (Mayer & Salovey, 1993)

²⁴ In the ACE model, understanding refers to identifying the causes and consequences of an emotion, whereas in other models (e.g., Gratz & Roemer's) it can also describe emotion clarity (e.g., '*I am confused about how I feel*' – DERS, Gratz & Roemer, 2004)

²⁵ Considered as one component of self-support in the ACE model (see Berking & Whitley, 2014)

health. A study conducted outside the scope of this thesis added preliminary evidence for the predictive role of compassion in using other ER skills and strategies (Paucsik et al., 2023). It seems that self-support allows better strategy implementation and adjustment also by acting jointly on other skills. For example, training self-compassion is hypothesised to improve tolerance of one's emotion (Diedrich et al., 2017) while also relying on awareness and acceptance (Neff, 2003). Together, these preliminary skills work in concert to facilitate the implementation of two others: acceptance and modification (Berking & Whitley, 2014).

Enhancing *acceptance* is currently involved in many treatments, among which those based on the ACT approach (Hayes et al., 1999). Acceptance has been either classified within the attentional deployment strategies' category (Gross's model) (e.g., Slutsky et al., 2017) or as a form of reappraisal (e.g., Webb et al., 2012), depending on whether we consider acceptance as influencing attention or as a way to understand the emotional experience (Wojnarowska et al., 2020, p.2). In the ACE model, acceptance is regarded as a skill applied when the emotion/situation cannot be modified. However, one can notice that the diverging perspectives on acceptance are more or less inclusive. For example, the ACT framework seems to encompass other skills, such as awareness, clarity, and understanding in the acceptance process. In turn, the ART approaches acceptance (as defined by the ACT) through divided subprocesses (Berking & Whitley, 2014). For example, the session on non-judgmental awareness directly echoes ACT's definition of the concept. Subdividing it or not, acceptance is opposed to avoidant processes (Hayes et al., 1999) and sounds to facilitate engagement with emotional information. Exploratory findings from our Study 4 suggest that acceptance and tolerance tend to predict more engagement strategies (and less disengagement strategies) in the selection stage. Acceptance and tolerance may foster individuals to confront difficult situations, leading them to favour engagement strategies such as reappraisal (e.g., Wupperman et al., 2008). This aligns with other studies showing acceptance to be specifically associated with decreased

psychopathology without being fully mediated by the modification skill (Berking et al., 2012). That is, acceptance seems to impact mental health uniquely, in contrast to other skills (e.g., awareness, clarity, understanding) that foster mental health by being mediated by the modification skill. Enhancing acceptance, and thus confronting difficult emotional experiences, may help individuals to pursue their longer-term goals by promoting approach behaviours.

Concurrently, the focus on *modification* in the ACE model has been supported by findings showing that this skill mediates the influence of the other skills on psychopathology, giving evidence to its superiority (Berking et al., 2012). This agrees with Study 1's findings, displaying modification as the ER skill most strongly associated with depressive symptoms. The modification skill can also be linked to the measure of expressive flexibility, i.e., the FREE scale (Burton & Bonanno, 2016), to the extent that the FREE assesses participants' ability to modify their emotional expression. Using this scale to measure specifically one aspect of the modification skill, Study 2 revealed a negative association between expressive suppression and stress symptoms, but not with depressive or anxious symptoms. Those results highlight the discrepancy between the perceived ability to apply one strategy and the frequency of use of a strategy (often positively associated with stress). Furthermore, this skill is widely associated with the perceived self-efficacy to change emotions. Indeed, studies support that positive expectations related to self-efficacy to regulate are associated with better mental health and can also count toward reducing avoidance (An et al., 2022; De Castella et al., 2018). In the ART, the *modification* involves calling on all previous skills that are integrated into a step-by-step approach to decide how to respond to a challenging emotional experience.

The impact of ER skills in the ER process has only been preliminary tested in this thesis, still providing exploratory evidence for the influence of such skills on the selection stage (Study 4), and showing that different interventions can enhance them (Study 5). However, future studies are needed to precisely delineate how these skills can be integrated into and influence

key ER processes – context-sensitivity (identification), repertoire (selection, implementation), and feedback (monitoring) - towards greater flexibility. Indeed, despite having been mentioned earlier in the ER literature²⁶, such skills seem to have hardly been integrated into ER models. This is of primary interest given their promising role in translating theoretical processes into targets of treatments (i.e., skills) in clinical interventions.

Hypothesising ER flexibility as a ‘meta’ process that requires multiple skills to be preliminary developed, training participants in ER skills appears to be a pathway (albeit it may not be the only one) to better apply strategies depending on the contextual demands. However, to ensure that ER skills work through the mediation of ER flexibility on mental health, we must be precise in measuring such a concept. As demonstrated throughout this thesis, flexibility has been operationalised in many ways, with most studies failing to account for its dynamics (Study 3). Our systematic review has shed light on the diverse definitions and operationalisations of ER flexibility, highlighting the need to integrate both experimental and daily designs in future studies.

1.2. Measuring flexibility: a challenge not yet resolved

Recent research has attempted to develop measures of ER flexibility, which this thesis has tried to address. Still, tools for accurately measuring flexibility are scarce and most of them suffer from important limitations. A first attempt through questionnaires resulted, for instance, in the Context-Sensitivity Index (CSI) and Flexible Regulation of Emotional Expression (FREE) scale. We have validated their French versions in Study 2, showing adequate

²⁶ The ER skills are not only described in the ACE model but also in other approaches such as in Gratz and Roemer’s definition of ER (2004, p.42-43): ‘*awareness, understanding, and acceptance of emotions, ability to control impulsive behaviours and engage in goal-directed behaviours when experiencing negative emotions, flexible use of situationally appropriate strategies to modulate the intensity and duration of emotional responses in order to meet individual goals and situational demands, and a willingness to experience negative emotions in pursuit of desired goals*’.

psychometric properties, convergent validity, and replicating the FREE's factorial structure, thus providing the French community with adequate scales assessing two components of flexibility. However, 'static' self-report assessments only succinctly address its dynamics and are further limited by their scenario-based structures that may suffer from high variability in terms of personal relevance. While they have been developed to address specific components of flexibility (context-sensitivity, repertoire), they are constrained by the even more specific factors they evaluate. For example, the CSI manipulates a limited number of contextual features (e.g., control, urgency), and the FREE refers to flexibly employing two sides of only one strategy (i.e., emotional expression).

A set of questionnaires attempted to measure more broadly the ability to switch between strategies, such as the Coping Flexibility Scale (Kato, 2012), which proposes items such as '*When stressed, I use several ways to cope and make the situation better*', '*I am aware of how successful or unsuccessful my attempts to cope with stress have been*'. Still, by relying heavily on retrospective assessment, it is based on the participants' ability to recall their emotional experiences and strategies accurately. This may be particularly compromised when mobilising the ability to discriminate between strategies and evaluate their success. Also, this scale only evaluates the perception of general regulatory behaviours without generalisability in real-life situations. Indeed, recent studies showed mixed results regarding the correspondence between global self-report and daily measures (Brockman et al., 2017; Koval et al., 2022), suggesting that questionnaires might in fact reflect the knowledge individuals have on their ER processes, or the representations they have on them. Individuals may rely on different levels of knowledge: *in situ* emotional experience would be considered as experiential knowledge, contextualised, whereas general retrospective self-report based on memory-related knowledge (Robinson & Clore, 2002). Since flexibility is more about a 'meta' process including covariation between diverse variables than a single deliberate action, such questionnaires may be limited to

accurately measure it (e.g., limited awareness of processes; Nisbett & Wilson, 1977) and are instead drawn on partial memory retrievals and beliefs about one's regulation.

Questionnaires reflect a static and oversimplified view of flexibility, disregarding its potential fluctuations and dynamics. However, such tools can be considered a first step in measuring trait-level flexibility and possibly be valuable when concurrently associated with other measures that better capture the dynamics. To mention one example, Bonanno et al. have found that FREE was consistently associated with a behavioural measure of expressive regulation (Burton & Bonanno, 2016).

Beyond a questionnaire-based approach, our experimental study gave further evidence for the influence of emotional intensity on ER choice and, more broadly, for the relevance of experimental designs to measure ER flexibility. However, measuring flexibility experimentally implies selecting specific (or a few) contextual features to be manipulated (in our study, the intensity of the images). Although it provides valuable information to identify which strategies are more chosen under which condition or difficulties associated with the selection stage, it is limited by the number of contextual characteristics such studies can involve and thus prevents from exploring possible interactions between several contextual features. The field currently benefits from the multiplication (and replication) of studies interested in specific contextual variables, in a cumulative science perspective. Still, it fails to integrate and cross the concurrent influence of multiple variables while being limited in their external validity.

To this end, daily designs can offer a possibility to measure the context in which the regulation occurs more widely. Although daily studies have flourished to measure flexibility, most used indices (e.g., standard deviation) are limited by the specific information they can provide. New indices have been utilised, such as the RMSSD in Study 5 (see Wenzel et al., 2021), which is close to others recently used (e.g., Bray-Curtis dissimilarity index - Lo et al., 2023). Some researchers are currently providing an impetus to evaluate and compare indices,

which will greatly benefit the field. For example, the work conducted by Dejonckheere et al. (2019) investigated to which extent affect dynamic measures are interdependent; their results suggested that it would be necessary to develop different indexes considering the high interdependency that can hardly be integrated into a single index. As we preliminarily attempted to compare two methods of operationalisation in Study 5, future research is encouraged to test and disentangle different indexes for flexibility.

Even though promising, all these indices currently fail to consider contextual features' influence on ER variability and do not demonstrate whether variability is indicative of flexibility. To that end, other techniques, such as network approaches, may provide insights into understanding the specific influence of each contextual feature (i.e., mapping context) and delineate which nodes are the most consistent ones within a dynamic system rather than looking at context as isolated variables.

As stated in our Systematic Review, both experimental and daily designs can provide information. Specifically, using mixed designs (i.e., experimental and daily measures) would be further beneficial by experimentally isolating specific processes (i.e., specific contextual features such as intensity in the selection stage) while concurrently increasing ecological validity in a longitudinal perspective. Thus, mixed designs would lead to a more comprehensive understanding of ER flexibility by leveraging the strengths of each approach while being implemented in systematic person-centred procedures. Concurrently, new technologies have started to be used to catch behavioural (e.g., social network use, microphone) and physiological (e.g., heart rate variability) mechanisms of ER and flexibility through wearable biosensors measures (e.g., wristband devices) (Colombo et al., 2019). In the same vein, Virtual Reality has, to our knowledge, not yet been incorporated in the study of ER and flexibility. Such an approach could facilitate the manipulation of various contexts through real-life scenarios.

1.3. Impact of clinical interventions on flexibility

Preliminary findings of Study 5 suggest that both interventions seem to decrease the variability in strategy-use when considering all strategies together. However, when considering these strategies separately, some of the variabilities seem to have increased after both interventions (e.g., Expression of the emotional experience, Relaxation), while others have indeed decreased (e.g., Self-support, Acceptance, Avoidance, Consumption). This diminution in variability could represent a more stable use across time, specifically for strategies that overlap with skills (e.g., Self-support, Acceptance). Thus, one possible explanation would be that some strategies are more context-sensitive (and more likely to vary across contexts) than others. For example, the influence of external contextual variability was significant for Relaxation, Problem-solving, and Acceptance from one alert to the next. Likewise, variability in internal context (emotional intensity) predicted increased variability in specific strategies, such as Reappraisal, Distraction, and Social support. Discrepant results emerged concerning the impact of the groups: while both interventions seem to decrease the influence of internal contextual variability on strategy-variability (when considering them altogether at the week-level), they concurrently seem to increase the impact of external contextual variability on strategy-variability at the alert-level. However, considering these findings preliminary, future studies are needed to precisely explore the impact of clinical interventions on the covariation between contextual changes and strategy-variability.

Even though the importance of flexibility is currently underlined by multiple authors (Battaglini et al., 2022; Sanchez-Lopez, 2021), flexibility measures are still scarce, and even more in testing the efficacy of clinical interventions. That is, the operationalisation of flexibility is still in its early stages, which we have tried to investigate in this thesis.

The recent development of ER flexibility has not yet led to novel interventions on ER. Most interventions targeting specifically ER rely on other existing treatments (e.g., CBT, DBT, ACT) and, as such, do not stem from ER theoretical models (e.g., process model - Gross, 2015) (Lincoln et al., 2022). More importantly, specific ER interventions do not show superiority over gold-standard interventions (e.g., CBT) (Berking et al., 2019; Moore et al., 2022; Sakiris & Berle, 2019; Wittkamp et al., 2023) when, concomitantly, the majority of interventions seems to improve ER in some way (Moore et al., 2022). Even compared to other active interventions (Study 5), findings do not support the superiority of ER specific interventions. Although surprising, this aligns with studies showing no clear superiority of CBT compared to active control conditions (Cuijpers et al., 2023). This suggests that different interventions can lead to ER (and possibly flexibility) improvements through different pathways (Gratz et al., 2015). Indeed, one can consider flexibility as being already targeted by multiple treatments to the extent that they work on increasing the individual's behavioural repertoire (and, at some point, the ER strategy's repertoire). By teaching individuals new tools (either through ART or Relaxation in Study 5), we enable them to live new experiences, and more importantly, we provide them with new ways to experience, behave, and respond to challenging situations.

Since current interventions do not address the ability to match strategies depending on the context (Lincoln et al., 2022), translational efforts from research to clinical practice are needed to better understand and improve *how* strategies are used (context-dependent) instead of focusing on *which* strategies are used. To illustrate, one recent conceptualisation proposed by Veilleux et al. (2022) introduces a 'thinking threshold' that individuals could identify, representing a limit above which emotion impairs thinking and thus guides them towards using behavioural strategies instead of cognitive ones.

Concurrently, translational efforts from practice to research are necessary. Flexibility involves analysing contextual cues, being aware of one's emotional experience, implementing

specific strategies while considering its consequences in relation to goals. This dynamic is at the core of functional analysis in therapy, on which subsequent choices are based. Yet, little research (whether RCT or not) focuses on functional analysis. Moreover, functional analysis can lead to better personalised interventions: extending program-based interventions, modular treatments are being developed (Chorpita et al., 2005), alternatively focusing on specific skills depending on the individual's strengths and weaknesses (Brakemeier & Herpertz, 2019; Venturo-Conerly et al., 2023). This modular approach can also benefit from disentanglement studies (or component studies; Cuijpers et al., 2019), which provide precious information upon testing separated hypothesised active ingredients. To date, disentanglement studies are scarce and are often underpowered. One exception is the study by Berking et al. (2013), which gave evidence for the add-in of ART in CBT compared to a CBT-only condition. Future research is essential to precisely identify which part of interventions could be isolated to have a specific impact on ER flexibility (Moore et al., 2022). In this perspective, repeated temporal examinations are essential to explore which skill improves, when, and how it influences outcomes (Kazdin, 2019).

Furthermore, testing the applicability of new technologies such as ESM in clinical context can have therapeutic potential. Beyond its use to measure flexibility (which operationalisations may be difficult to incorporate into clinical contexts), such methods can foster individuals' awareness and provide help in deciding which strategy to implement. To illustrate, Leonard et al. (2018) have developed an application to enhance ER through physiological (e.g., electrodermal activity) and self-report measures. Thus, the app can notify the participant of a high-stress level and provide personalised tools in real-time.

2. Limitations

We first acknowledge that some of the studies presented in this thesis were subject to classic limitations associated with cross-sectional designs. The studies were also subjected to common recruitment biases, such as predominantly female and student samples, limiting the generalisability of our findings. While this thesis was guided by principles of open science, in particular by the pre-registration of studies, this process also highlighted the fact that it is sometimes difficult, particularly in fields under construction, to have exhaustive pre-registration. This was the case, for example, for the scripts used to calculate the flexibility indexes.

Secondly, this work was built on a large body of literature, which may seem to lack integration. Thus, each study has drawn from distinct (yet related and overlapping) perspectives on ER. Study 1 stemmed from Berking et al.'s model, Study 2 from Bonanno and al.'s background and Study 4 followed Sheppes and Gross's outlook. Beyond the fact that this thesis has represented the opportunity to browse and test, amongst specific studies, current models of ER and ER flexibility, we have also tried to present an integrative view of ER and ER flexibility at the end of this thesis and hope that it could be a premise of an integrative model.

Thirdly, we would like to raise an important limitation related to the RCT (Study 5). Indeed, considering the prevalence of psychological difficulties among French university students (Frajerman et al., 2023), we were surprised by the limited number of participants that contacted us and the number of dropouts throughout the study. The principal explanation was that a nine-session program was incompatible with students' university schedules. But what does it tell us about the consideration of mental health in our university services? This social question is of primary importance, especially considering that French media has increasingly raised concerns about university students' mental health. When eventually a free psychological

intervention was offered, taking place in the campus facilities, most students were not involved, and the large majority of included students ended up leaving the study. Most of our participants had trouble attending the sessions because of their schedules. There seems to be an inconsistency between institutions' acknowledgement of mental health issues on one side and the concrete measures taken on the other. Can we consider that proper care conditions are offered to students searching for help? Therefore, further quantitative and qualitative studies are needed to understand the barriers to our intervention.

3. Perspectives

3.1. On flexibility definitions

A repetitive matter discussed throughout this thesis concerned the variety of flexibility definitions. This concept has been approached by many fields (e.g., neuroscience, cognitive, social, developmental, clinical psychology; Moore et al., 2022), but has probably suffered the consequences of a lack of integration and interdisciplinary work. At times domain-specific (e.g., cognitive flexibility), definitions of flexibility unify under the umbrella of a dynamic balance comprising both a shielding part (e.g., sticking to one's goal, perseverance) and a shifting part (e.g., switching strategy, flexible adaptation to changes in the environment). This *shielding-shifting dilemma* (see Goschke & Bolte, 2014; Pruessner et al., 2020) sheds light on the importance of an equilibrium between stability and flexibility, as a constant trade-off between two antagonistic (yet complementary) modes of control (Dreisbach & Fröber, 2019). It illustrates how flexibility differs from variability to the extent that flexibility also encompasses the ability to sometimes act rigidly to attain one's goals.

Beyond commonalities in definitions, flexibility can also benefit from connections between specific research areas. For example, much work is currently done on the underlying cognitive capacities associated with flexibility. Pruessner et al. (2020) focused on cognitive control, including inhibiting prepotent responses, updating information in working memory and shifting mental sets. Further research could investigate associations between cognitive flexibility and ER flexibility. Indeed, being flexible in regulation requires both inhibition, update, and shifting cognitive abilities. Such explorations could open new avenues in clinical practices by isolating specific cognitive impairments implicated in emotion dysregulation. Several studies have started this research by focusing on the links between particular strategies and executive functions (Yang et al., 2017). This could also raise the chicken-or-egg question on whether flexibility (and its deficits) can be considered as an antecedent or consequence of psychological difficulties. Since psychological disturbances are often associated with cognitive impairments (Uddin, 2021) and that flexibility mobilises cognitive resources (Diamond, 2013), one could hypothesise flexibility to be disrupted by prior diminished cognitive abilities. In turn, a lack of flexibility could lead to perseverative ER functioning, thus emphasising flexibility as a predictor of symptoms.

3.2. What do we need to be flexible after all?

What is a good repertoire? How many strategies should we own? Could we set a threshold above which to consider too much or too little variability in strategy use as in a U-shape curved trajectory? As stated in Bonanno and Burton's piece (2013), preliminary research has been interested in measuring (a) the number of strategies and found, for example, that a larger repertoire was associated with lower traumatic stress in time (Orcutt et al., 2014) and lower distress (Lam & McBride-Chang, 2007). Other studies have assessed (b) temporal

variability (change in time) and shown its association with fewer depressive symptoms (Cheng, 2001). Another set of studies has evaluated (c) categorical variability (using a range of strategies) and demonstrated its links with decreased depression and anxiety (Lougheed & Hollenstein, 2012). However, most subsequent studies focus on whether individuals switch strategies facing different contexts (e.g., Sheppes & Meiran, 2008), that is, assessing flexibility without measuring adaptability (Aldao et al., 2015). Recent studies have also suggested that it may not be so much the repertoire's *size* that counts as its specific *composition* (Grommisch et al., 2020; Southward et al., 2018). For example, Grommisch et al. (2020) found that specific combination of strategies used over time (repertoire's composition) was associated with well-being (in contrast to the repertoire' size), with more diverse profiles characterised by greater use of situation selection, modification, social sharing, and acceptance strategies being associated with higher pleasant affect, fewer anxiety and stress symptoms. Future studies are needed to explore when, under which circumstances and on which criteria basis flexibility is adaptive.

3.3. *A final thought on the pitfalls of emotion regulation research*

We study ER. But are we studying it appropriately? For example, do individuals regulate all the time? Do experimental designs instructing individuals to make a choice amongst strategies really reflect how individuals regulate on a daily basis? Or are we experimentally measuring what people think they would do to regulate in theory, that is, their *knowledge* on ER? Before measuring strategy selection, it sounds necessary to preliminary assess whether individuals spontaneously choose to regulate their emotions in the first place. If people do not always regulate emotions, what are they doing? From a functionalist approach, all behaviour has a function; applied to ER, can't we consider all emotion-related behaviours as strategies

(e.g., going for a walk to decrease anger, watching a TV show to distract oneself from anxiety)? In the ACT framework, acceptance is not theoretically defined as a strategy (Hayes et al., 1999). However, acceptance fosters meaningful actions and, at some point, entails an attentional redirection process. So, what is an ER strategy? Isn't it all actions (whether cognitive or behavioural) that have the function of acting on our emotions or acting according to our goals, despite emotional activation? Similarly to the expanded list of strategies provided in our ESM protocol (Study 5), future studies are encouraged to offer a wider choice of strategies (e.g., relaxation, consumption, etc.), or to design protocols using open questions to avoid restricting participants to a forced list.

Finally, most studies have defined and measured the efficacy of ER in the short-term, that is, the extent to which the strategy was efficient to *feel* good (hedonic purpose). However, research has shown the paradox of hedonism that often implicates poor longer-term outcomes (*paradoxical rebound effect* - Ciarrochi et al., 2022). Thus, one can wonder whether ER is about *feeling* good or *doing* good. Accordingly, one can question the different outcomes used to assess adaptability of regulation (e.g., decrease in negative affect vs goal's achievement). For example, the functional contextualism approach described by the ACT (Hayes et al., 1999) defines ER as adaptive when the responses to emotions promote growth, meaning, and basic needs satisfaction. Hence, separating short- from long-term implications of ER appears challenging to the extent that poor short-term outcomes can concurrently benefit longer-term ones. For example, one could benefit from maintaining emotional intensity in the short-term (e.g., distress tolerance) to better achieve a longer-term goal (e.g., decrease avoidant behaviours). In that perspective, a *good* choice among the repertoire would be mostly defined as whether it benefits long-term outcomes (even when in conflict with short-term, hedonic goals), whatever the repertoire's size is. Considering flexibility as a multi-determined concept, future research needs to integrate more systematically the various components it implies.

4. General conclusion

This thesis dissertation aimed to explore emotion regulation flexibility through its conceptual definitions, operationalisations, and clinical interventions while subscribing to a processual and transdiagnostic approach.

Going further than the typical static categorisation of strategies, the present thesis reviewed studies consistently showing that ER choice and adaptability depend on context. That is, adaptive regulation requires flexibility. But defining which (external and internal) contextual factors is endless, given the complex interactions that form both external and internal features. Importantly, this thesis emphasises the need for conceptual clarity in ER, and eventually in ER flexibility, towards improved operationalisations. For clinical practices to benefit from affective science research, we need to not only focus on how ER flexibility *works*, but also study whether it should and how it can be *improved*. Beyond teaching strategies, we should also focus on prerequisite skills that can facilitate ER identification, selection, implementation, and monitoring to better respond to contextual demands.

Anchored in a theory-to-practice approach, this dissertation has contributed to clarifying emotion regulation flexibility and has raised future research directions.

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Supplementary Material

CHAPTER 1 – STUDY 1: FRENCH VALIDATION OF THE EMOTION REGULATION SKILLS QUESTIONNAIRE (NARDELLI ET AL., 2023)

Table 1. French ERSQ Descriptive Data _____	289
Table 2. Canadian ERSQ Descriptive Data _____	290
Table 3. French correlations between ERSQ Subscales and ERQ, DERS, FFMQ _____	291
Table 4. Canadian correlations between ERSQ Subscales and ERQ, DERS, FFMQ _____	292
Table 5. Model Fit and Goodness-of-fit Indices of the ERSQ _____	293
Table 6. Standardised estimates of confirmatory analysis _____	294
Table 7. Fit indices comparisons _____	295
Table 8. Internal consistency of the questionnaires _____	296

CHAPTER 2 – STUDY 2: FRENCH VALIDATION OF THE CONTEXT SENSITIVITY INDEX AND FLEXIBLE REGULATION OF EMOTIONAL EXPRESSION SCALE (NARDELLI ET AL., IN SUBMISSION)

Table 1. Preliminary French version of the CSI _____	297
Table 2. Preliminary French version of the FREE scale _____	299
Table 3. Correlation between T1 & T2 for bilinguals – Dimensions and total scores _____	300
Table 4. Correlations between T1 & T2 for bilinguals - items _____	301
Table 5. Test-retest between items at one-month interval _____	301
Table 6. Model fit and Goodness-of-fit Indices of the FREE _____	302

CHAPTER 2 – STUDY 3: SYSTEMATIC REVIEW ON EMOTION REGULATION FLEXIBILITY MEASURES (NARDELLI ET AL., IN SUBMISSION)

Table 1. Words searched in the literature _____	303
Table 2. Summary of experimental designs _____	304
Table 3. Summary of daily designs _____	306

Table 4. Theoretical definitions _____	307
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CHAPTER 2 – STUDY 4: EXPERIMENTAL STUDY ON EMOTION REGULATION CHOICE (NARDELLI ET AL., 2023)

Definitions of strategies _____	308
Table 1. GEE logistic regressions analyses (Replication task) _____	310
Table 2. GEE logistic regressions (Extension task) _____	310
Table 3. Spearman correlations between ERSQ-total score and strategies _____	311
Table 4. ID number of each image used in the current study _____	312
Table 5. Descriptive statistics on the images' choices _____	313

CHAPTER 3 – STUDY 5: REFLEX: A RCT TESTING THE EFFICACY OF THE ART PROGRAM

Table 1. ESM protocol _____	314
Figure 1. Descriptive comparisons between groups at pre- and post-intervention _____	317
Figure 2. Mean emotional intensity per group and per time _____	318
Figure 3. Descriptive strategy-use means per Group and per Time _____	319
Figure 4. Effect of Time, Group, and Time*Group on ER skills per dimension _____	320
Table 2. Method 1: Within-strategy variability with Time, Group, and ECV as predictors _____	324
Table 3. Method 1: Within-strategy variability with Time, Group, and ICV as predictors _____	327
Table 4. Method 2: Within-strategy variability with Time, Group, and ECV as predictors _____	330
Table 5. Method 2: Within-strategy variability with Time, Group, and ICV as predictors _____	333
CV _____	336

Table 1*French ERSQ Descriptive Data (internal consistency, test-retest reliability and intercorrelations of the ERSQ scales)*

Scale	M ± SD (n = 377)	α	ω	Test- retest (n = 158)	1	2	3	4	5	6	7	8
1.Awareness	7.68 ± 2.57	.76	.76	.57**	-	-	-	-	-	-	-	-
2.Sensations	7.49 ± 2.94	.80	.81	.58**	.56**	-	-	-	-	-	-	-
3.Clarity	8.03 ± 2.70	.83	.83	.64**	.72**	.50**	-	-	-	-	-	-
4.Understanding	8.16 ± 2.70	.84	.84	.76**	.72**	.47**	.79**	-	-	-	-	-
5.Acceptance	6.98 ± 2.52	.66	.67	.53**	.54**	.30**	.50*	.54**	-	-	-	-
6.Tolerance	7.12 ± 2.95	.84	.84	.58**	.41**	.17*	.42**	.44**	.75**	-	-	-
7.Confrontation	8.20 ± 2.46	.72	.74	.59**	.37**	.27**	.34**	.36**	.49**	.53**	-	-
8.Self-support	7.58 ± 2.66	.79	.80	.43**	.56**	.45**	.46**	.48**	.42**	.48**	.49**	-
9.Modification	6.34 ± 2.68	.76	.76	.63**	.60**	.39**	.46**	.51**	.51**	.57**	.48**	.68**

Note. ω : omega; α : Cronbach's alpha; M: mean; SD: Standard Deviation; *: $p = .001$, after B.Hochberg's correction; **: $p < .0001$.

Table 2

Canadian ERSQ Descriptive Data (internal consistency and intercorrelations of the ERSQ scales)

Scale	M ± SD (n = 281)	α	ω	1	2	3	4	5	6	7	8	9
1.Awareness	8.07 ± 2.17	.74	.74	-	-	-	-	-	-	-	-	-
2.Sensations	7.06 ± 2.70	.77	.77	.47**	-	-	-	-	-	-	-	-
3.Clarity	8.44 ± 2.30	.81	.82	.75**	.49**	-	-	-	-	-	-	-
4.Understanding	8.53 ± 2.35	.84	.84	.76**	.49**	.79**	-	-	-	-	-	-
5.Acceptance	7.64 ± 2.36	.74	.75	.63**	.39**	.58*	.57**	-	-	-	-	-
6.Tolerance	8.00 ± 2.58	.85	.85	.61**	.33*	.55**	.60**	.78**	-	-	-	-
7.Confrontation	8.34 ± 2.33	.73	.74	.56**	.31**	.45**	.46**	.53**	.52**	-	-	-
8.Self-support	8.05 ± 2.33	.75	.75	.52**	.35**	.43**	.47**	.48**	.50**	.52**	-	-
9.Modification	7.01 ± 2.43	.75	.76	.53**	.35**	.37**	.46**	.50**	.52**	.45**	.62**	-

Note. ω: omega; α: Cronbach's alpha; M: mean; SD: Standard Deviation; *: $p = .001$, after B.Hochberg's correction; **: $p < .0001$.

Table 3

French Correlations between ERSQ Subscales and ERQ, DERS, FFMQ

Scales	ERQ-R	ERQ-S	DERS-A	DERS -C	DERS-NA	DERS-S	CES-D	FFMQ Total	FFMQ Awar	FFMQ Accep	FFMQ Toler
AWARE	.25**	-.30**	-.65**	-.50**	-.27**	-.39**	-.37**	.63**	.18**	.25**	.38**
SENSA	.19**	-.25**	-.46**	-.29**	-.13*	-.22**	.12*	.53**	.19*	.24**	.20**
CLARI	.11*	-.38**	-.58**	-.60**	-.33**	-.33**	-.39**	.60**	.19**	.22**	.29**
UNDER	.15**	-.28**	-.56**	-.60**	-.32**	-.38**	-.40**	.60**	.26**	.24**	.36**
ACCEP	.25**	.21**	-.35**	-.36**	-.41**	-.45**	-.39**	.40**	.08	.18**	.50**
TOLER	.31**	-.11*	-.26**	-.39**	-.47**	-.56**	-.47**	.40**	.08	.15*	.60**
CONFR	.26**	-.13*	-.27**	-.38**	-.31**	-.41**	-.43**	.39**	.17**	.24**	.32**
SELF-S	.44**	-.20**	-.41**	-.36**	-.31**	-.47**	-.40**	.50**	.13*	.16*	.46**
MODIF	.44**	-.19**	-.39**	-.38**	-.34**	-.57**	-.49**	.50**	.09	.15*	.47**

Note. * : $p < .03$, after B.Hochberg's correction; **: $p < .01$; ERQ-R: Emotion Regulation Questionnaire – Reappraisal; ERQ-S: Emotion Regulation Questionnaire – Suppression; DERS-A: Difficulties in Emotion Regulation Scale – Awareness; DERS-C: Difficulties in Emotion Regulation Scale – Clarity; DERS-NA: Difficulties in Emotion Regulation Scale – Non Acceptance; DERS – S: Difficulties in Emotion Regulation – Strategies; FFMQ: Five Facets Mindfulness Questionnaire; FFMQ Awar: awareness; FFMQ Accep: acceptance(non-judgmental subscale); FFMQ Toler: tolerance (non-reactivity subscale); CES-D: Centre for Epidemiologic Studies Depression Scale; AWARE: Awareness; SENSA: Sensations; CLARI: Clarity; UNDER: Understanding; ACCEP: Acceptance; TOLER: Tolerance; CONFR: Confrontation; SELF-S: Self-support; MODIF: Modification.

Table 4*Canadian Correlations between ERSQ Subscales and ERQ, DERS, FFMQ*

Scales	ERQ-R	ERQ-S	DERS-A	DERS -C	DERS-NA	DERS-S	CES-D	FFMQ Total	FFMQ Awar	FFMQ Accep	FFMQ Toler
AWARE	.21**	-.29**	-.54**	-.53**	-.32**	-.39**	-.39**	.58**	.40**	.34**	.41**
SENSA	.12*	-.17*	-.39**	-.34**	-.16**	-.19**	-.15*	.44**	.20**	.17**	.34**
CLARI	.10	-.40**	-.52**	-.58**	-.30**	-.34**	-.36**	.57**	.35*	.34**	.34**
UNDER	.18**	-.31**	-.53**	-.57**	-.27**	-.33**	-.34**	.57**	.34**	.29**	.41**
ACCEP	.14**	-.18**	-.40**	-.43**	-.44**	-.37**	-.42**	.53**	.28**	.46**	.53**
TOLER	.14**	-.16**	-.33**	-.43**	-.40**	-.46**	-.46**	.52**	.30**	.42**	.57**
CONFR	.12*	-.16**	-.30**	-.32**	-.27**	-.27**	-.43**	.38**	.31**	.24**	.31**
SELF-S	.32**	-.14**	-.34**	-.31**	-.20**	-.31**	-.37**	.39**	-.25**	-.22**	.33**
MODIF	.42**	-.14*	-.35**	-.40**	-.31**	-.38**	-.45**	.49**	-.33**	-.30**	.45**

Note. *: $p < .03$, after B.Hochberg's correction; **: $p < .01$; ERQ-R: Emotion Regulation Questionnaire – Reappraisal; ERQ-S: Emotion Regulation Questionnaire – Suppression; DERS-A: Difficulties in Emotion Regulation Scale – Awareness; DERS-C: Difficulties in Emotion Regulation Scale – Clarity; DERS-NA: Difficulties in Emotion Regulation Scale – Non Acceptance; DERS – S: Difficulties in Emotion Regulation – Strategies; FFMQ: Five Facets Mindfulness Questionnaire; FFMQ Awar: awareness; FFMQ Accep: acceptance(non-judgmental subscale); FFMQ Toler: tolerance (non-reactivity subscale); CES-D: Centre for Epidemiologic Studies Depression Scale; AWARE: Awareness; SENSA: Sensations; CLARI: Clarity; UNDER: Understanding; ACCEP: Acceptance; TOLER: Tolerance; CONFR: Confrontation; SELF-S: Self-support; MODIF: Modification.

Table 5

Model Fit and Goodness-of-fit Indices of the ERSQ across the Two Samples and the Total Sample (measurement invariance)

	n	χ^2	df	p	CFI	TLI	SRMR	RMSEA	RMSEA [90% CI]	$\Delta\chi^2$	Δ CFI
France	377	835.6	288	<.001	.904	.883	.06	.071	[.07-.08]	-	-
Canada	281	637.1	288	<.001	.914	.896	.05	.066	[.06-.07]	-	-
Total sample – Model 1	658	1668.1	576	<.001	.952	.941	.05	.060	[.06-.07]	-	-
Total sample – Model 2	658	1434.2	594	<.001	.957	.949	.06	.071	[.07-.08]	43.764	+ .005
Total sample – Model 3	658	1354.8	666	<.001	.955	.952	.06	.069	[.06-.07]	105.49	- .002

Note. Df: degree of freedom; CFI: Comparative Fit Index; TLI: Tucker-Lewis Index; SRMR: Standardized Root Mean Square Residual; RMSEA: Root Mean Square Error of Approximation; CI: Confidence of Interval; Δ : difference. Model 1 imposed no equivalence restriction; Model 2 has equivalence restriction on factor loadings; Model 3 has equivalence restriction on factor loadings and intercepts.

Table 6

Standardized estimates of confirmatory analysis of the total sample, French and Canadian subsamples

	Std. FR	Uniq FR	Std. CA	Uniq CA	LFC	LFC	LFC FR	LFC CA
UNDER					UNDER	AWARE	.92	.97
ERSQ_11	.85	.278	.89	.208		CLARI	.96	.95
ERSQ_3	.81	.344	.82	.328		SENSA	.63	.65
ERSQ_20	.87	.243	.84	.294		TOLER	.55	.72
AWARE						ACCEP	.76	.74
ERSQ_1	.62	.616	.68	.538		SELF-S	.61	.62
ERSQ_19	.86	.260	.83	.311		MODIF	.65	.61
ERSQ_12	.78	.392	.74	.452		CONFR	.50	.60
CLAR					AWARE	CLARI	.93	.97
ERSQ_13	.81	.344	.80	.360		SENSA	.73	.66
ERSQ_6	.80	.360	.83	.311		TOLER	.58	.79
ERSQ_25	.87	.243	.84	.294		ACCEP	.82	.87
SENSA						SELF-S	.73	.71
ERSQ_14	.75	.438	.65	.578		MODIF	.81	.71
ERSQ_7	.98	.040	.98	.040		CONFR	.55	.77
ERSQ_24	.67	.551	.65	.578	CLARI	SENSA	.66	.65
TOLER						TOLER	.54	.68
ERSQ_26	.87	.243	.85	.278		ACCEP	.73	.76
ERSQ_18	.80	.360	.83	.311		SELF-S	.58	.57
ERSQ_4	.85	.278	.87	.243		MODIF	.59	.50
ACCEPT						CONFR	.48	.62
ERSQ_17	.69	.524	.73	.467	SENSA	TOLER	.25	.44
ERSQ_5	.82	.328	.84	.294		ACCEP	.43	.54
ERSQ_23	.48	.770	.65	.578		SELF-S	.57	.48
SELSUPP						MODIF	.51	.46
ERSQ_27	.87	.243	.77	.407		CONFR	.35	.48
ERSQ_9	.79	.376	.80	.360	TOLER	ACCEP	.63	.64
ERSQ_15	.74	.452	.69	.524		SELF-S	.61	.66

	Std. FR	Uniq FR	Std. CA	Uniq CA	LFC	LFC	LFC FR	LFC CA
MODIF						MODIF	.73	.71
ERSQ_10	.82	.328	.86	.260	ACCEPT	SELF-S	.63	.67
ERSQ_2	.72	.482	.65	.578		MODIF	.75	.71
ERSQ_21	.73	.468	.73	.467		CONFR	.71	.74
CONFRONT					SELF-S	MODIF	.88	.82
ERSQ_8	.90	.190	.78	.392		CONFR	.65	.72
ERSQ_16	.75	.438	.75	.438	MODIF	CONFR	.65	.65
ERSQ_22	.59	.652	.71	.500				

Note. ERSQ: Emotion Regulation Skills Questionnaire; AWARE: Awareness; CLAR: Clarity; SENS: Sensations; TOLER: Tolerance; ACCEPT: Acceptance; SELFSUPP: Self-support; MODIF: Modification; CONFRONT: Confrontation. Std.FR: Standardized estimates for the French subsample; Std.CA: Standardized estimates for the Canadian subsample; Uniq FR: Uniqueness for the French subsample; Uniq CA: Uniqueness for the Canadian subsample; LFC: latent factor correlations.

Table 7

Fit indices comparisons between one-factor, nine-factor, and higher-order models (total sample)

Model	χ^2	df	<i>p</i>	CFI	RMSEA
One-factor	22366,567	451	<.001	.80	.14
Nine-factor	1668.08	576	<.001	.95	.06
Higher-order	1894.996	315	<.001	.84	.08

Notes. Df: degrees of freedom; CFI: Comparative Fit Index; RMSEA: Root Mean Square Error of Approximation.

Table 8*Internal consistency of the questionnaires*

Model	French sample	Canadian sample	Total sample
ERQ – Reappraisal ($\alpha;\omega$)	.77;.78	.77;.77	.78;.78
ERQ – Suppression ($\alpha;\omega$)	.76;.79	.78;.78	.78;.78
DERS – Total score ($\alpha;\omega$)	.93;.94	.93;.94	.93;.94
CES-D – Total score ($\alpha;\omega$)	.94;.94	.93;.93	.94;.94
FFMQ – Total score ($\alpha;\omega$)	.87;.97	.90;.91	.89;.90

Note. ERQ: Emotion Regulation Questionnaire; DERS: Difficulties in Emotion Regulation Scale; CES-D: Centre for

Epidemiologic Studies Depression Scale; FFMQ: Five Facets Mindfulness Questionnaire. α : Cronbach's alpha; ω : omega.

Table 1

Preliminary French version of the CSI

Lisez les courtes descriptions des situations suivantes qui peuvent se présenter dans votre vie quotidienne. Pour chaque situation, prenez d'abord quelques instants pour essayer d'imaginer que vous êtes réellement dans cette situation, puis répondez aux questions qui suivent en encerclant le chiffre qui correspond le mieux à votre réponse.

1. Un-e ami-e vous appelle et vous demande de rendre service à son-sa partenaire, que vous n'aimez pas.

- a. A quel point avez-vous du contrôle sur ce qui va se passer ensuite dans cette situation ?
- b. A quel point les autres ont-ils du contrôle sur ce qui va se passer ensuite dans cette situation ?
- c. A quel point avez-vous besoin de la coopération des autres pour réagir à cette situation ?
- d. A quel point cette situation est-elle menaçante ?

1. Pas du tout 2 3 4 5 6 7. Beaucoup

2. Votre partenaire présente un risque de diabète et son médecin lui a conseillé de suivre un régime. Il-elle refuse.

- a. A quel point avez-vous du contrôle sur ce qui va se passer ensuite dans cette situation ?
- b. A quel point les autres ont-ils du contrôle sur ce qui va se passer ensuite dans cette situation ?
- c. A quel point avez-vous besoin de la coopération des autres pour réagir à cette situation ?
- d. A quel point cette situation est-elle menaçante ?

1. Pas du tout 2 3 4 5 6 7. Beaucoup

3. Vous êtes en train de marcher dans la rue quand vous voyez une personne glisser et tomber. Elle se cogne la tête en tombant au sol.

- a. A quel point avez-vous du contrôle sur ce qu'il va se passer ensuite dans cette situation ?
- b. A quel point devez-vous réagir de manière urgente dans cette situation ?
- c. A quel point avez-vous besoin de la coopération des autres pour répondre à cette situation ?

1. Pas du tout 2 3 4 5 6 7. Beaucoup

4. Vous prenez un médicament qui vous rend nauséeux·se. Votre médecin vous dit que ce n'est pas grave et que vous devez poursuivre votre traitement en prenant « votre mal en patience ».

- a. A quel point les autres ont-ils du contrôle sur ce qui va se passer ensuite dans cette situation ?
- b. A quel point devez-vous réagir de manière urgente dans cette situation ?
- c. A quel point avez-vous besoin de la coopération des autres pour répondre à cette situation ?

1. Pas du tout 2 3 4 5 6 7. Beaucoup

5. Vous lisez un livre en attendant votre vol. Quand l'avion commence à décoller, vous réalisez que vous avez laissé le livre dans la zone d'embarquement.

- a. A quel point avez-vous du contrôle sur ce qui va se passer ensuite dans cette situation ?
- b. A quel point devez-vous réagir de manière urgente dans cette situation ?
- c. A quel point la situation est-elle menaçante ?

1. Pas du tout 2 3 4 5 6 7. Beaucoup

6. Vous voyez quelqu'un dans la rue frapper soudainement une autre personne. Il·Elle se tourne vers vous avec colère en disant "Qu'est-ce que vous regardez ?".

- a. A quel point les autres ont-ils du contrôle sur ce qui va se passer ensuite dans cette situation ?
- b. A quel point devez-vous réagir de manière urgente dans cette situation ?
- c. A quel point la situation est-elle menaçante ?

1. Pas du tout 2 3 4 5 6 7. Beaucoup

Note. Each appraisal dimension is scored following the key below. Reverse coded items are indicated by capital "R" such that a response of 1 is scored as 7, a response of 2 is scored as 6, etc. Cue Presence scores, which represent sensitivity to the presence of cues, are created by totaling the non-reversed items while Cue Absence scores, which represent sensitivity to the relative absence of cues, are created by totaling the reversed items.

Cue Presence (10 items):

$(1a + 2b + 2c + 2d + 3a + 3b + 3c + 6a + 6b + 6c)$

Cue Absence (10 items, all reversed coded):

$(1bR + 1cR + 1dR + 2aR + 4aR + 4bR + 4cR + 5aR + 5bR + 5cR)$

Table 2*Preliminary French version of the FREE scale*

L'expression de nos émotions fait partie intégrante de notre vie quotidienne. Pour des raisons sociales, nous devons parfois montrer plus d'émotions que nous n'en ressentons, et parfois nous devons montrer moins d'émotions que nous n'en ressentons.

Les scénarios suivants impliquent une émotion POSITIVE. Pour chaque scénario, indiquez à quel point vous seriez capable d'être encore PLUS EXPRESSIF·VE que d'habitude à propos de ce que vous ressentiriez :

- 1) Un·e ami·e gagne un prix dans un sport qui ne vous intéresse pas.
- 2) Un·e collègue de travail obtient une promotion et veut en parler.
- 3) Un·e ami·e vous parle d'un super rendez-vous galant qu'il·elle a eu l'autre soir.
- 4) Vous recevez un cadeau d'un membre de votre famille, mais c'est une chemise que vous n'aimez pas.

1. Incapable 2 3 4 5 6. Tout à fait capable

Les scénarios suivants impliquent une émotion NÉGATIVE. Pour chaque scénario, indiquez à quel point vous seriez capable d'être encore PLUS EXPRESSIF·VE que d'habitude à propos de ce que vous ressentiriez :

- 5) Votre ami·e vous raconte la journée terrible qu'il·elle a passée.
- 6) Votre patron·ne se plaint d'un projet que vous connaissez peu et dans lequel vous n'êtes pas impliqué·e.
- 7) Un·e ami·e parle d'une rupture que vous pensez secrètement être une bonne chose.
- 8) Vous assistez aux funérailles de quelqu'un que vous ne connaissez pas.

1. Incapable 2 3 4 5 6. Tout à fait capable

Les scénarios suivants impliquent une émotion POSITIVE. Pour chaque scénario, indiquez à quel point vous seriez capable de DISSIMULER ce que vous ressentiriez :

- 9) Alors que vous dînez avec un·e ami·e qui vient de perdre récemment son emploi, vous recevez un appel de votre patron·ne vous annonçant que vous allez avoir une augmentation.
- 10) Vous êtes en formation et vous voyez une faute de frappe drôle dans le diaporama du·de la présentateur·rice.
- 11) Vous êtes invité·e à une cérémonie religieuse solennelle et la personne assise à côté de vous vient de vous chuchoter une blague drôle.
- 12) Lors d'une réunion avec un·e supérieur·e, son téléphone se met inopinément à jouer une sonnerie embarrassante.

1. Incapable 2 3 4 5 6. Tout à fait capable

Les scénarios suivants impliquent une émotion NÉGATIVE. Pour chaque scénario, indiquez à quel point vous seriez capable de DISSIMULER ce que vous ressentiriez :

13) Vous êtes à un événement social et la personne à qui vous parlez postillonne fréquemment pendant qu'elle parle.

14) Vous venez d'apprendre le décès d'un-e proche juste avant une réunion de travail importante.

15) Vous êtes à un premier rendez-vous galant dans un restaurant pour dîner, et un-e inconnu-e renverse sa boisson sur vous.

16) Après avoir passé une journée très désagréable et stressante, un-e voisin-e parfois agaçant-e passe vous dire bonjour.

1. Incapable 2 3 4 5 6. Tout à fait capable

Table 3

Correlation between T1 & T2 for bilinguals – Dimensions and total scores

Scale	Subscales						
FREE	Enhance positive	Enhance negative	Suppress positive	Suppress negative	Enhancement	Suppression	Repertoire
	.37**	.44**	.50**	.68**	.48**	.58**	.62**
CSI	Cue Presence	Cue Absence	Context sensitivity				
	.42**	.52**	.48**				

Note. *: $p < .05$ (after B.Hochberg's correction); **: $p < .001$.

Table 4*Correlation between T1 & T2 for bilinguals – items*

Item Scale	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
FREE	.49**	.40**	.34**	.51**	.41**	.26*	.31**	.35**	.35**	.27**	.39**	.48**	.56**	.48**	.56**	.51**	-	-	-	-
CSI	.42**	.38**	.44**	.41**	.55**	.43**	.27**	.29**	.64**	.28**	.36**	.28**	.41**	.41**	.23**	.54**	.44**	.16*	.37**	.26**

Note. *: $p < .05$ (after B.Hochberg's correction); **: $p < .001$.

Table 5*Test-retest between items at one-month interval*

Item Scale	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
FREE	.55**	.53**	.55**	.62**	.58**	.58**	.60**	.60**	.64**	.66**	.66**	.65**	.68**	.70**	.65**	.63**	-	-	-	-
CSI	.62**	.59**	.66**	.62**	.73**	.65**	.70**	.69**	.73**	.63**	.70**	.61**	.72**	.73**	.64**	.68**	.67**	.64**	.64**	.67**

Note. *: $p < .05$ (after B.Hochberg's correction); **: $p < .001$.

Table 6

Model Fit and Goodness-of-fit Indices of the FREE across the Two Samples and the Total Sample (measurement invariance).

	n	χ^2	df	<i>p</i>	CFI	TLI	SRMR	RMSEA	RMSEA [90% CI]	$\Delta\chi^2$	<i>p</i>	Δ CFI
Total sample – Model 1	782	2364.9	240	<.001	.995	.994	.05	.017	[.00-.03]	-	-	-
Total sample – Model 2	782	2364.9	240	<.001	.995	.994	.05	.018	[.00-.03]	10.895	.69	.009
Total sample – Model 3	782	2364.9	240	<.001	.985	.984	.05	.028	[.02-.04]	10	<.001	-.023

Notes. Df: degree of freedom; CFI: Comparative Fit Index; TLI: Tucker-Lewis Index; SRMR: Standardized Root Mean Square Residual; RMSEA: Root Mean Square

Error of Approximation; CI: Confidence of Interval; Δ : difference. Model 1 imposed no equivalence restriction; Model 2 has equivalence restriction on factor loadings;

Model 3 has equivalence restriction on factor loadings and intercepts.

CHAPTER 2 – STUDY 3: EMOTION REGULATION FLEXIBILITY: A SYSTEMATIC REVIEW ON
EXPERIMENTAL AND DAILY MEASURES (NARDELLI ET AL., IN SUBMISSION)

Table 1

Words searched in the literature. To get included, studies must mention at least one word of each column. (i.e., emotion regulation AND flexibility)

(“emotion regulation” OR “emotional regulation” OR “emotion management” OR “cognitive reappraisal” OR “Emotional Avoidance” OR “Experiential Avoidance” OR “Cognitive Avoidance” OR “acceptance” OR “emotional suppression” OR “rumination” OR “distraction”) AND (“flexibility” OR “adaptability” OR “variability” OR “choice” OR “context” OR “Ecological Momentary Assessment” OR “Experience Sampling Method”).

Emotion Regulation	Flexibility
Emotion regulation	Flexib*
Emotion* regulation	Adaptability
Emotion management	Variability
Cognitive reappraisal	Choice
Acceptance	Context
Emotion* suppression	Ecological momentary assessment
Rumination	Experience sampling method
Distraction	
Emotional Avoidance	
Experiential Avoidance	
Cognitive Avoidance	

Table 2*Summary of experimental designs*

Article	Stimuli	Strategies	Flexibility index
Sheppes et al., 2011 Sheppes et al., 2014		Reappraisal/Distractio Reappraisal/Distractio	- Subtraction of distraction choice in low intensity pictures from proportion of distraction in high intensity pictures
Levy-Gigi et al., 2016		Reappraisal/Distractio	Responsiveness to Internal Feedback score
Birk & Bonanno, 2016		Reappraisal/Distractio	
Millgram et al., 2019 Agyriou & Lee, 2020 Hannan & Orcutt, 2020 Hay et al., 2021 Martins et al., 2018 Orejuela-Davila et al., 2019 Sauer et al., 2015 Scheibe et al., 2015 Young & Suri, 2019 Alkoby et al., 2019 Shafir et al., 2016 Murphy & Young, 2017 Feldman & Freitas, 2021	Pictures from IAPS (intensity)	Rumination/Distractio Reappraisal/Distractio Reappraisal/Distractio Reappraisal/Distractio Reappraisal/Distractio Reappraisal/Distractio Reappraisal/Distractio Reappraisal/Distractio Reappraisal/Distractio Reappraisal/Distractio Reappraisal/Distractio Reappraisal/Distractio	-
Bonanno et al., 2004	Pictures from IAPS + information from an observer		-
Gupta & Bonanno, 2011		Enhance/Suppress	-
Zhu et al., 2017	Bonanno's paradigm		Regulatory scores
Myruski et al., 2019			Late positive potential difference scores
Hill, 2021	Role play	Spontaneous strategies	Observed regulatory flexibility score
Goubet & Chryssikou, 2019	Hypothetical situations (areas of life, controllability & intensities)	Spontaneous strategies 12 proposed strategies	Regulatory effort Total distinct strategy Flexibility Repertoire Total strategies

Oakley, 2020	Short emotional film clips	6 strategies	Average of difference between increase and decrease, and between approach vs avoid goal for each strategy + general ER flexibility index (sum of absolute values of acceptance and suppression flexibility)
Tang & Huang, 2019	Imaginary scenarios	16 strategies	-
Aldao & Nolen-Hoeksema, 2012	Autobiographic emotion-eliciting situations	7 strategies	Standard deviation between strategies across situations
Dixon-Gordon et al., 2015	Autobiographic emotion-eliciting situations	7 strategies	GEE
Greenaway et al., 2021	Film-clips	6 strategies	Multinomial logistic regression

Note. ER: Emotion Regulation; IAPS: International Affective Picture System; GEE: Generalized Estimating Equation.

Table 3*Summary of daily designs*

Article	ESM Protocol	Strategies	Statistical strategy
Pavani et al., 2016	5 daily assessments over 2 weeks	Positive reappraisal, problem-focused coping, appreciation, and rumination	GEE
Southward et al., 2019	3 times per day during 10 days	20 proposed strategies	HLM
Southward et al., 2020	24 hourly occasions during 2 days	Problem-solving, acceptance, impulsive behavior, pushing the emotion away, digging into or savouring the emotion	HLM
English et al., 2017	Most positive and most negative event each day during 1 week	Distraction, reappraisal, suppression	MLM
O'Toole et al., 2017	2 daily over 11 days	Expressive suppression, and cognitive reappraisal	MLM
Medland et al., 2020	1-week 8 times per day	12-item short version RESS Momentary affect strongest emotion of the last hour (intensity, controllability of emotion and of situation)	Multilevel structural equation modelling
Haines et al., 2016	1-week 10 times per day	Reappraisal	MLM: index of covariation between change in reappraisal use and perceived controllability
Benson et al., 2019	21-days Event-contingent	Face-to-face interactions (social context) Expressive suppression Cognitive reappraisal	Standard deviation of repeated measures + multilevel modelling
Finkelstein et al., 2019	Every evening for 7 days	14 types of coping	Within-subject situational fit index for each daily response (person-centered deviation score for controllability appraisals and each of coping item)
Blanke et al., 2020	4 existing ESM studies	Several types of strategies	Standard deviations

Oakley 2020	14-days once a day	6 strategies on the most stressful event of the day	Within-person variation in the use of strategies Level of strategy use + person-specific residuals in strategy use
Wang et al., 2021	10 days – 5 times per day	7 strategies	Standard deviations MLM
Blanke et al., 2021	4 days – 6 times per day	5 strategies	MLM

Note. *ESM: Experience Sampling Method; GEE: Generalized Estimating Equation; HLM: Hierarchical Linear Modeling; MLM: Multilevel Modeling.*

Table 4

Theoretical definitions

Concept	Definition
Within-strategy variability	Variability with which one strategy is used over time (Aldao et al., 2015)
Between-strategy variability	Variability with which different strategies are used over time (Aldao et al., 2015)
Flexibility	Degree of covariation between ER variability and changes in the environment (Aldao et al., 2015)
Adaptability	Degree at which ER flexibility facilitates the pursuit of personally meaningful goals (Aldao et al., 2015)
Context sensitivity	Ability to perceive impinging demands and opportunities from the situational context (Bonanno & Burton, 2013)
Repertoire	Ability to utilize a wide range of regulatory strategies (Bonanno & Burton, 2013)
Feedback	Ability to monitor and use feedback about the efficacy of a strategy over time to adjust or correct behavior when needed (Bonanno & Burton, 2013)

Definition of emotional regulation strategies

In our daily lives, we use various strategies to reduce, maintain, or increase our pleasant or unpleasant emotions. These strategies refer to emotional regulation strategies, which are the processes by which individuals try to consciously and unconsciously decrease or increase the intensity of their emotions, in order to respond appropriately to their environment (Aldao et al., 2010).

The following definitions represent certain emotional regulation strategies.

For the sake of the study, we ask you to take note of them.

Rumination: When we ruminate, our thoughts are focused on the causes, consequences, and meaning of a situation. We try to understand why an event happened, why we have certain thoughts or emotions, or to anticipate potentially negative consequences.

For example: asking yourself often why you are sad, thinking about something that upsets you in order to understand its meaning, etc.

Distraction: We use distraction when we focus our attention and our thoughts on something that is not related to what we are experiencing. The idea is to occupy our minds with more neutral things so that we don't think or feel the negative emotion.

For example: thinking about your evening meal, a song, etc.

Reappraisal: Reappraisal is used to take a step back from the situation that is triggering a negative emotion. We think about the situation in a different way (by putting things into

perspective, considering other interpretations, or looking at things from a more neutral or positive angle), so that we are less affected by the emotions it provokes.

For example: reinterpreting a failure as an opportunity to improve, taking a step back from a frightening film by telling yourself it's not real, etc.

Suppressing the expression of emotions: When we suppress the expression of our emotions, we inhibit and hide the facial expressions linked to the emotion we are feeling. The aim is to ensure that emotions do not appear on our face.

For example: keep a poker face, adopt a neutral expression.

Acceptance: Acceptance means actively and consciously accepting the thoughts and emotions that arise in the moment, without trying to change their form or frequency.

For example, observing your thoughts and emotions as they come and go, without trying to control, modify or avoid them.

Behavioural avoidance: Behavioural avoidance is an action we take to avoid feeling the emotion by avoiding the situation that provokes it.

For example, looking away when you feel embarrassed in front of someone, or leaving a place that frightens you so that you don't feel the emotion.

Relaxation: When we relax, we regulate our emotions by focusing on our bodily sensations. This may involve regulating your breathing or gradually relaxing your muscles to calm down.

For example: do breathing exercises, relax your muscles one by one, etc.

Once you have familiarised yourself with these strategies, click on the arrow to continue.

Table 1

GEE logistic regression analyses predicting the probability of choosing distraction by condition and ER skills in the Replication task

Model	β	<i>SE</i>	<i>Exp</i> (β)	<i>Exp</i> (β) %2.5 – 97.5	<i>Wald</i>	<i>p-value</i>	<i>QIC</i>
Intercept	-0.62	0.07	0.54	0.47-0.62	69.68	< . 001	4404.35
Condition	1.84	0.15	6.28	4.71-8.39	155.08	< . 001	
ERSQ	-0.01	0.01	0.99	0.98-1.00	6.61	.010	
Condition* ERSQ	-0.02	0.01	0.98	0.96-1.00	3.17	.075	

Note. β = coefficient on the logit scale; SE = Standard error; QIC = Quasi-Likelihood Information Criterion.

Table 2

GEE logistic regression analyses predicting the probability of choosing disengagement strategies by condition and ER skills in the Extension task

Model	β	<i>SE</i>	<i>Exp</i> (β)	<i>Exp</i> (β) %2.5 – 97.5	<i>Wald</i>	<i>p-value</i>	<i>QIC</i>
Intercept	-0.27	0.06	0.76	0.68-0.86	21.43	< . 001	4766.35
Condition	1.40	0.12	4.06	3.23-5.12	141.76	< . 001	
ERSQ	-0.01	0.00	0.99	0.98-1.00	3.28	.07	
Condition* ERSQ	-0.01	0.01	0.99	0.98-1.01	0.49	.49	

Note. β = coefficient on the logit scale; SE = Standard error; QIC = Quasi-Likelihood Information Criterion.

Table 3*Spearman correlations between ERSQ-total score and strategies*

	<i>ERSQ Total score</i>	
	<i>r</i>	<i>p</i>
Expressive suppression	-0.22	.01
Distraction	0.00	.99
Reappraisal	0.08	.34
Rumination	-0.06	.49
Behavioural avoidance	-0.09	.31
Acceptance	0.13	.16
Relaxation	0.11	.21

Note. In **bold** correlations that were statistically significant. *r*: coefficient of correlation. All associations were tested using the total % of strategies chosen in both conditions of the Extension task.

Table 4*ID number of each image used in the current study*

	Low intensity	High intensity
Replication task training	N°2100	N°3131
	N°2455	N°3266
	N°2683	N°9635
	N°2694	N°9921
	N°6940	N°9405
	N°8485	N°9433
Extension task training	N°9046	N°3015
	N°9102	N°3019
	N°9182	N°3100
	N°9341	N°3168
Extension task	N°2115	N°2375
	N°2301	N°2981
	N°2480	N°3001
	N°2718	N°3005
	N°2811	N°3010
	N°6315	N°3063
	N°9050	N°3064
	N°9220	N°3181
	N°9330	N°3213
	N°9404	N°6415
	N°9445	N°9040
	N°9471	N°9185
	N°9590	N°9435
	N°9800	N°9635
N°9832	N°9921	
Replication task	N°1301	N°2053
	N°2278	N°2800
	N°2312	N°3000
	N°2490	N°3068
	N°2691	N°3140
	N°2700	N°3150
	N°6010	N°3180
	N°6190	N°3230
	N°6836	N°3261
	N°7360	N°3530
	N° 9102	N° 6831
	N°9120	N°9181
	N°9160	N°9252
	N°9440	N°9410
N°9470.	N°9420	

Table 5*Descriptive statistics on the images' choices*

	Low Condition	High Condition	
Replication task		Total counts	Total counts
<i>Reappraisal (% ± SD, counts)</i>	82.0 ± 20.5, 12	1574	813
<i>Distraction (% ± SD, counts)</i>	18.0 ± 20.5, 3	346	1107
Extension task			
<i>Reappraisal (% ± SD, counts)</i>	13.6 ± 12.0, 2	261	202
<i>Distraction (% ± SD, counts)</i>	6.8 ± 7.41, 1	131	243
<i>Avoidance (% ± SD, counts)</i>	4.1 ± 6.49, 1	78	577
<i>Rumination (% ± SD, counts)</i>	11.7 ± 11.9, 2	225	185
<i>Suppression (% ± SD, counts)</i>	9.3 ± 10.4, 1	179	201
<i>Relaxation (% ± SD, counts)</i>	6.6 ± 9.56, 1	127	148
<i>Acceptance (% ± SD, counts)</i>	45.5 ± 24.2, 7	873	358
<i>Other (% ± SD, counts)</i>	2.4 ± 10.1, 0	46	6

Note. %: Mean percentage of time when the strategy was chosen; SD: Standard deviation

Table 1

ESM protocol

Context.

I was:

At home	At work	Transport	At someone's	In the street
Other:	At school/University			

I was:

Alone	Accompanied
-------	-------------

If accompanied, by whom?

Family	Friends	Colleagues	Medical staff	Unknown people
Partner	Other:			

Activity.

House keeping	Resting activity	Transport	Social activity
Indoor leisure	Professional activity	Medical	Self-care (shower..)
Outdoor leisure	Other:		

Self-support: 'I tried to reassure myself, to cheer myself up, to comfort myself in the situation'

Tolerance: 'I tried to support, to tolerate my emotions'

Other strategy:.....

Adaptability (short and long-term goals)

For each of the following goals, participants have to answer Yes or No and rate the extent to which they managed to do it with the following scale:

0 ----- 10

Not at all

Completely

1. *Did you want to reduce your emotion? (hedonic, short term)*
2. *Did you want to increase your emotion? (hedonic, short term)*
3. *Did you want to accomplish/do something? (instrumental, short term)*

Were your strategies consistent with the type of person you want to be? (long term)

Figure 1

Descriptive comparisons between groups at pre-(1) and post-(3) intervention

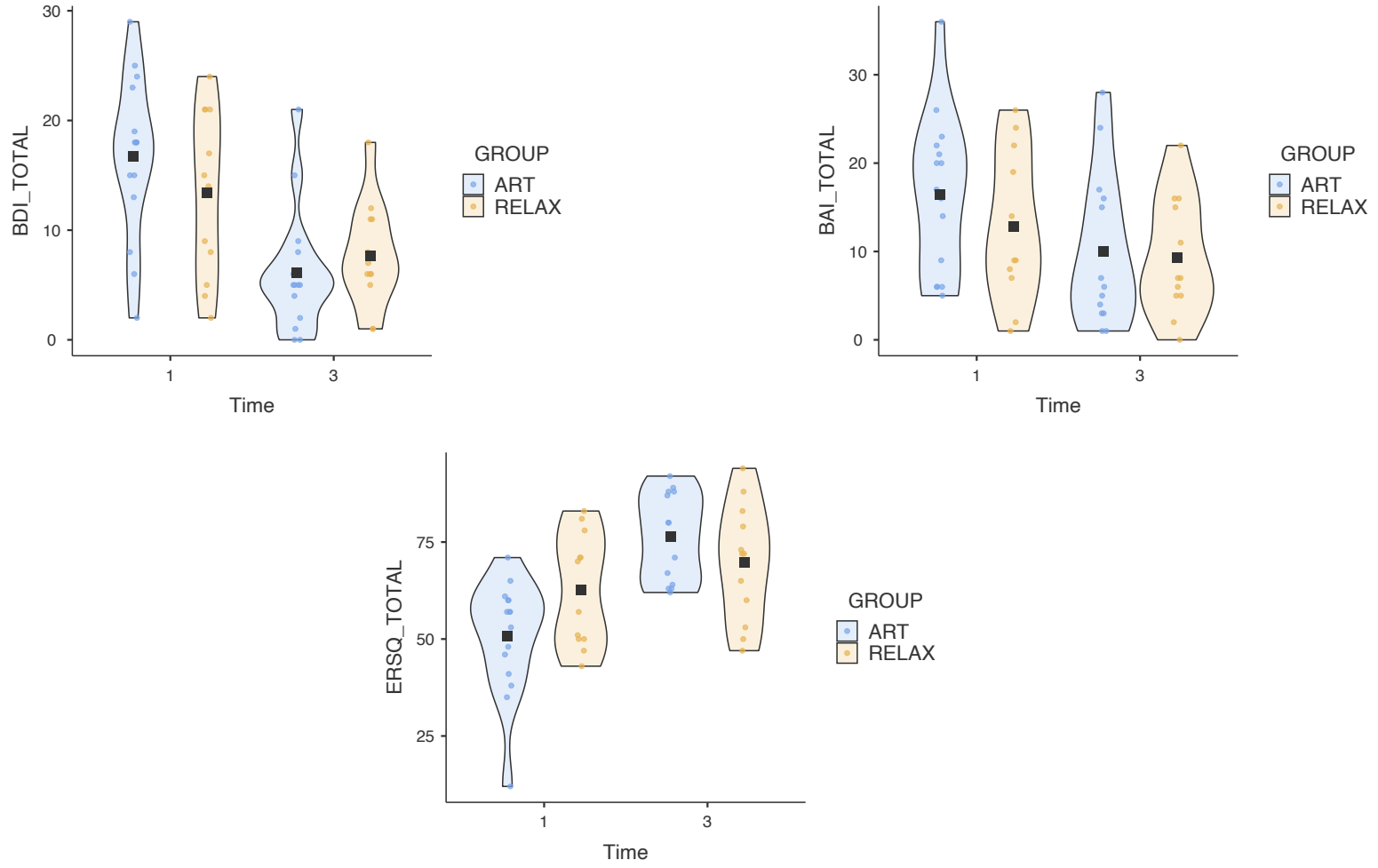


Figure 2

Mean emotional intensity per group and per time

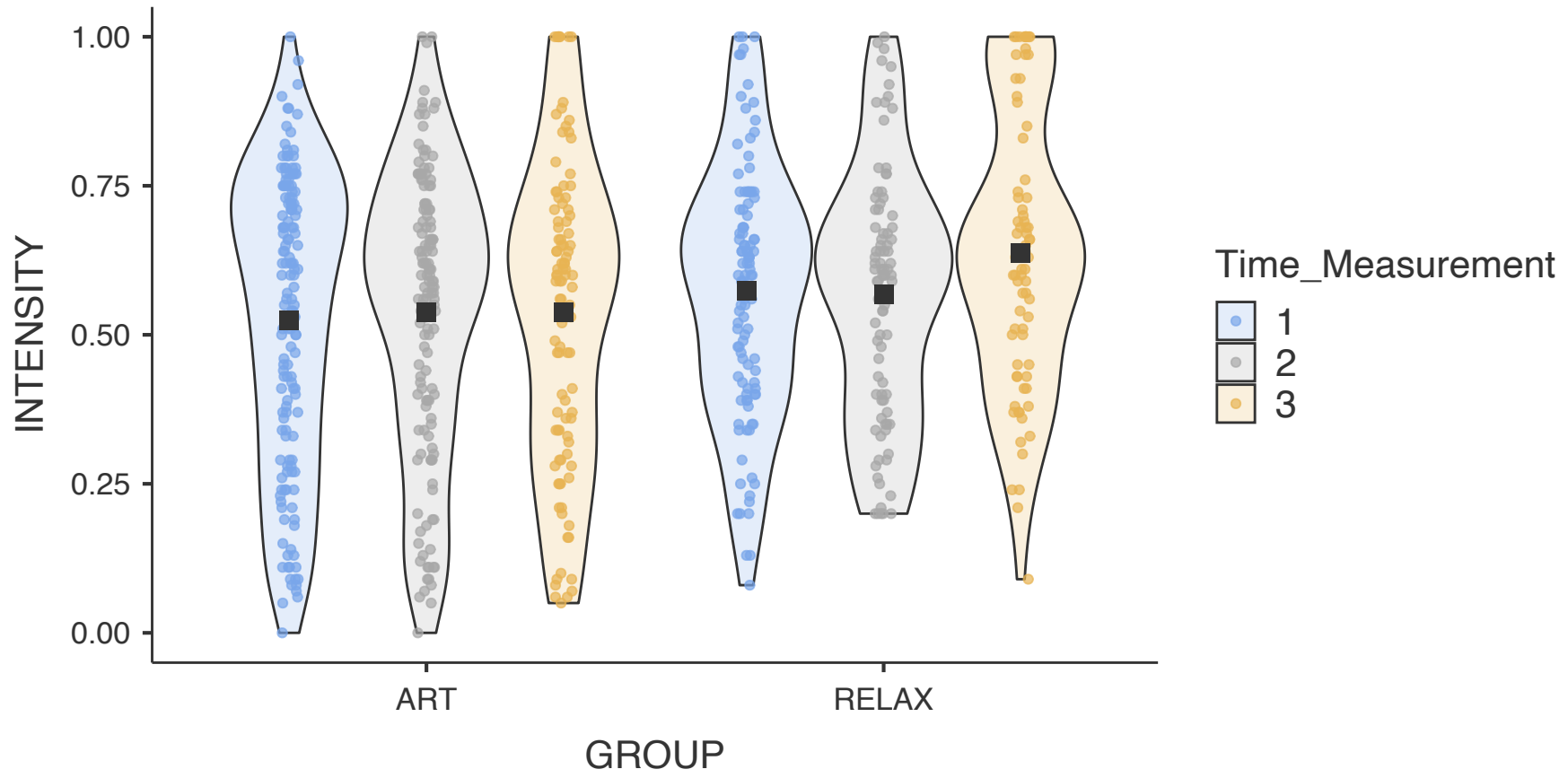
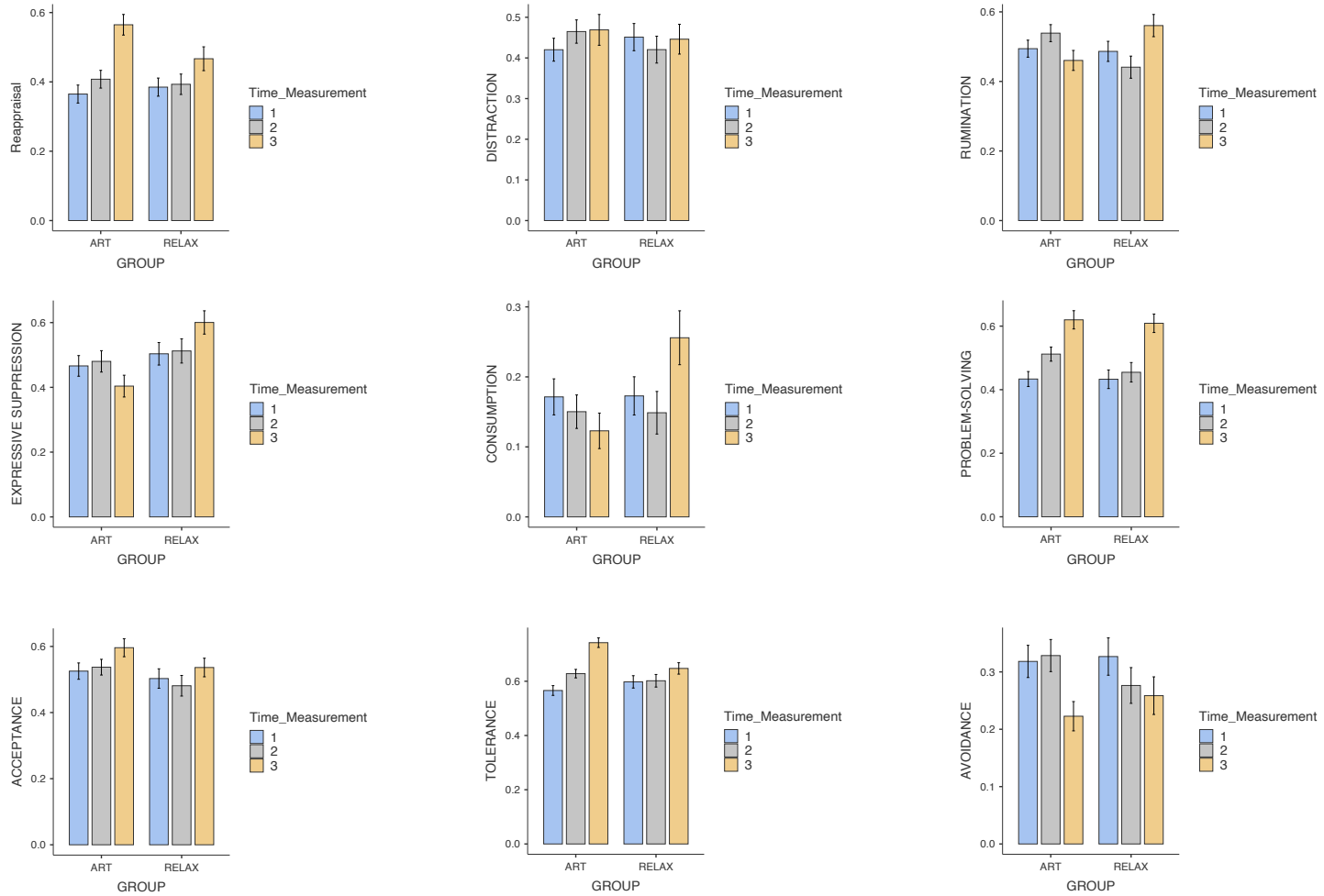


Figure 3

Descriptive strategy-use means per Group and per Time



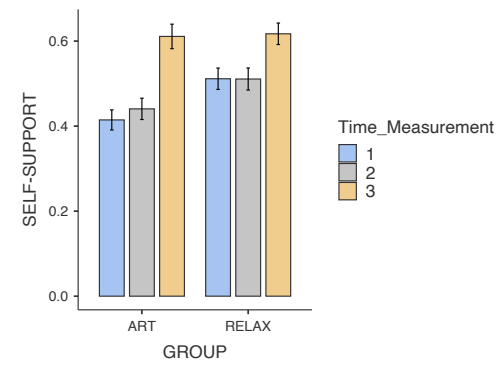
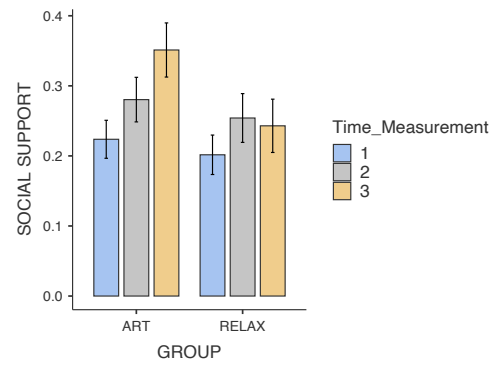
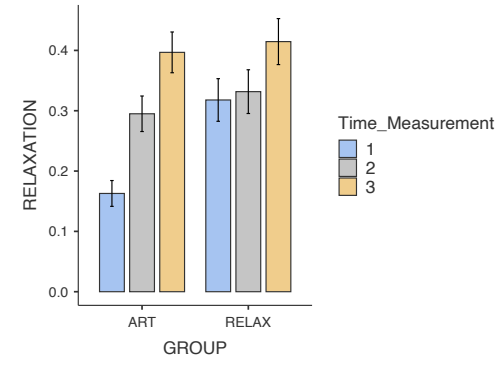
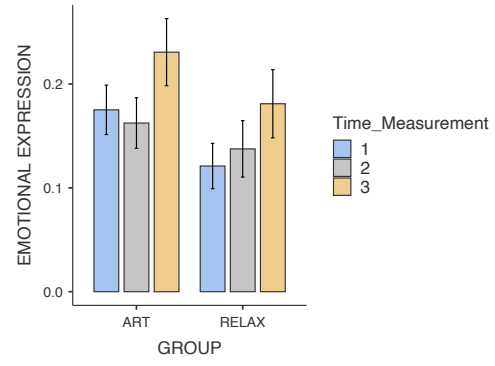
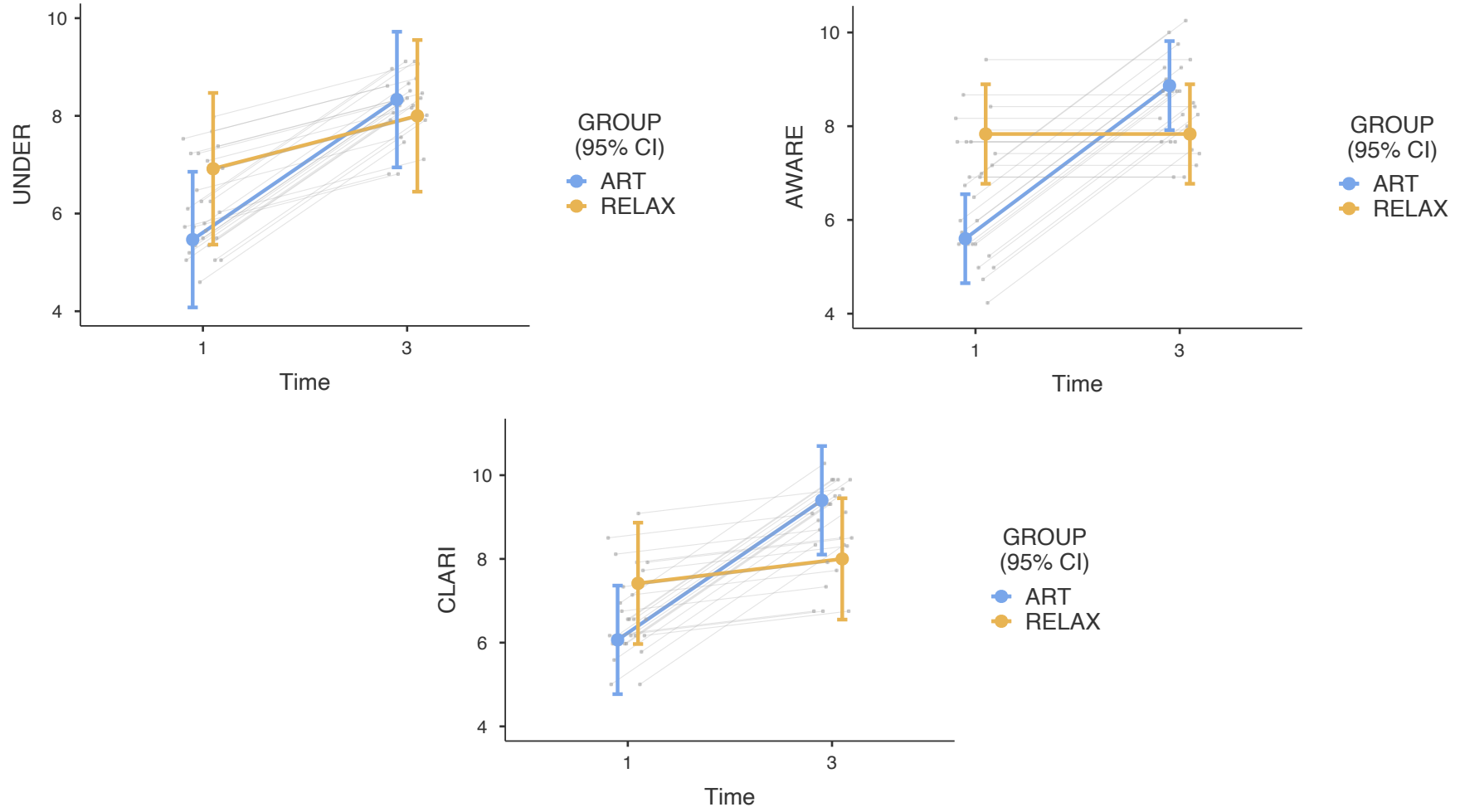
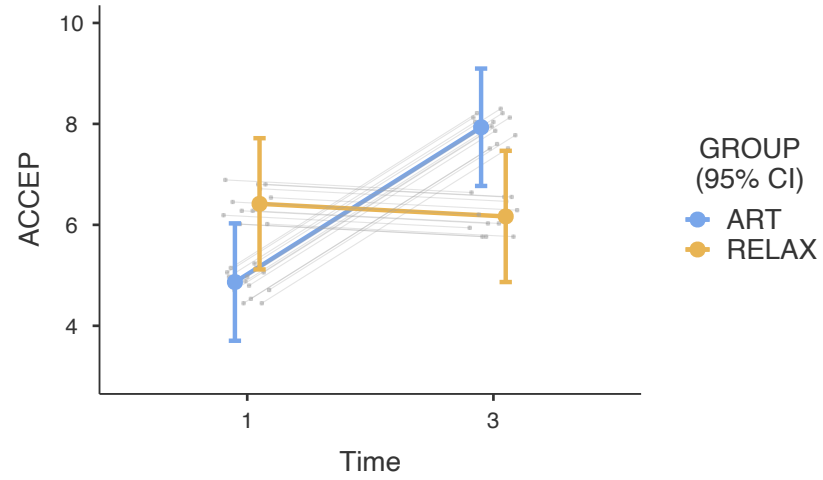
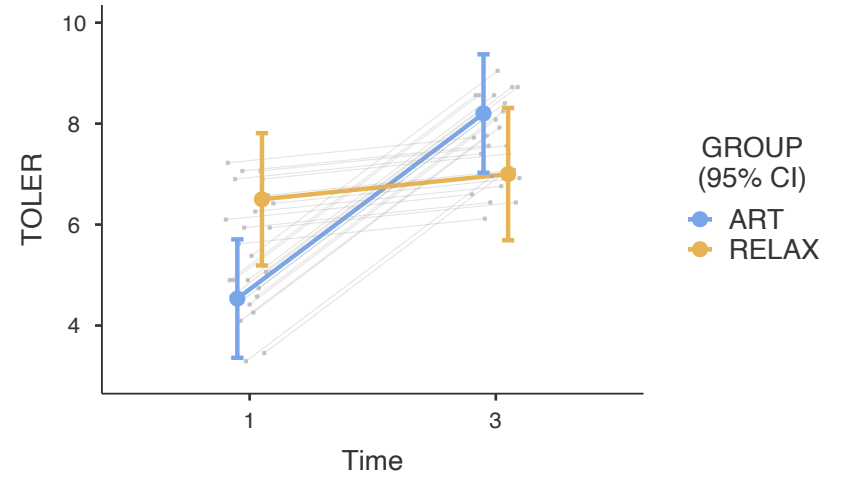
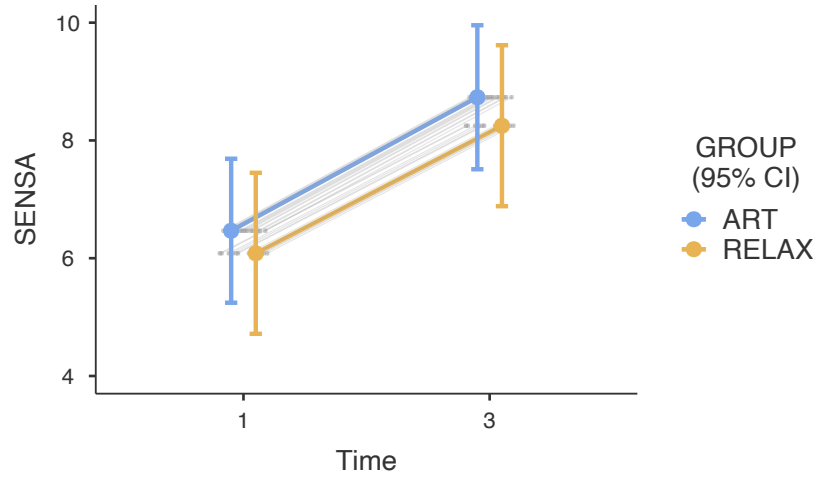


Figure 4

*Effect of Time, Group, and Time*Group on ER skills per dimension*





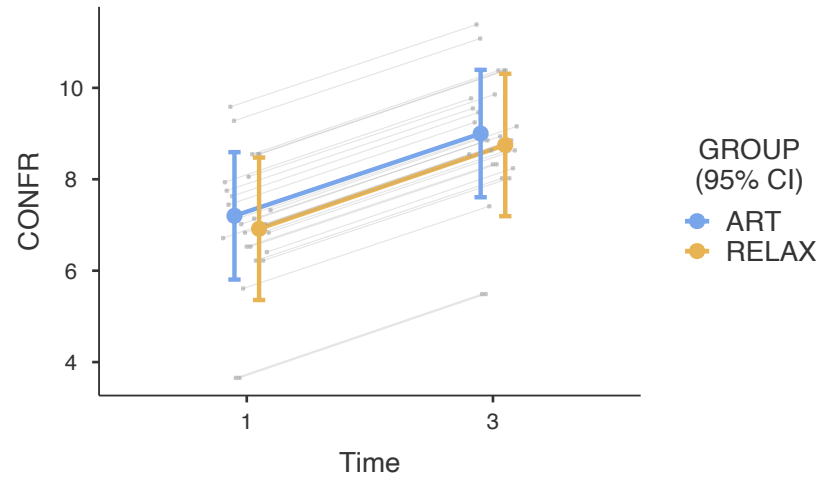
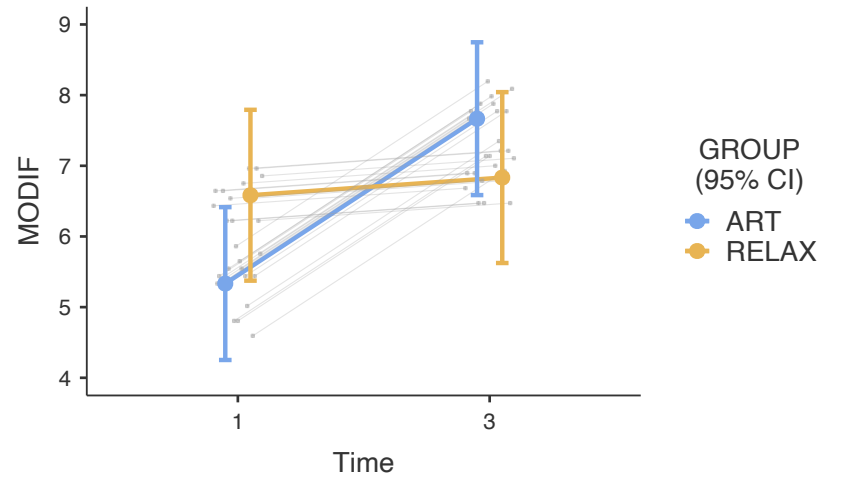
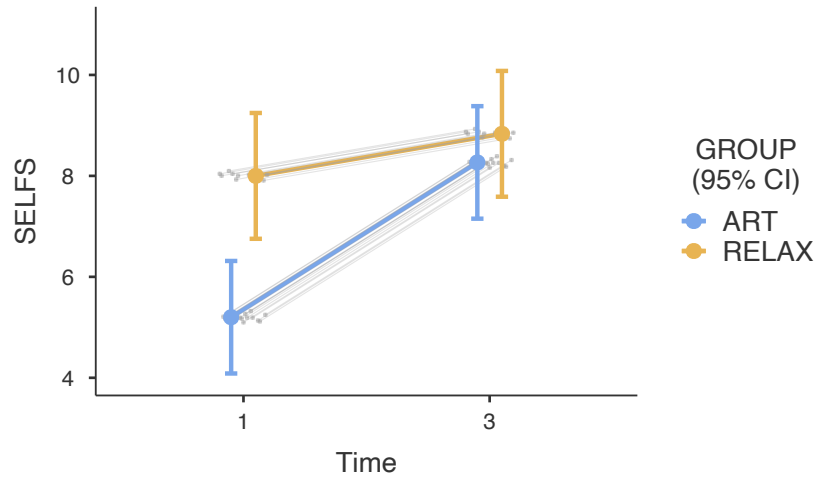


Table 2

Method 1: Within-strategy variability with Time, Group, and ECV as predictors

Cognitive Reappraisal within-variability						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau00$	<i>ICC</i>	R^2/Ω^2
<i>(Intercept)</i>	0.42	0.36 – 0.47	< . 001	0.02, 0.01	0.27	0.177/0.403
<i>Time</i>	-0.06	-0.15 – 0.04	.231			
<i>Time*Group</i>	-0.14	-0.33 – 0.04	.126			
<i>ECV</i>	0.19	-0.05 – 0.43	.118			
<i>Time*Group*ECV</i>	0.85	0.01 – 1.70	.049			
Distraction within-variability						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau00$	<i>ICC</i>	R^2/Ω^2
<i>(Intercept)</i>	0.51	0.45 – 0.57	< . 001	0.04, 0.01	0.19	0.091/0.261
<i>Time</i>	-0.04	-0.16 – 0.07	.462			
<i>Time*Group</i>	-0.06	-0.30 – 0.18	.619			
<i>ECV</i>	0.12	-0.17 – 0.41	.421			
<i>Time*Group*ECV</i>	0.26	-0.84 – 1.35	.639			
Tolerance within-variability						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau00$	<i>ICC</i>	R^2/Ω^2
<i>(Intercept)</i>	0.28	0.23 – 0.34	< . 001	0.02, 0.01	0.40	0.113/0.465
<i>Time</i>	-0.02	-0.10 – 0.07	.700			
<i>Time*Group</i>	-0.04	-0.21 – 0.12	.599			
<i>ECV</i>	-0.12	-0.35 – 0.11	.314			
<i>Time*Group*ECV</i>	-0.77	-1.53 – -0.02	.045			
Self-Support within-variability						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau00$	<i>ICC</i>	R^2/Ω^2
<i>(Intercept)</i>	0.37	0.32 – 0.43	< . 001	0.02, 0.02	0.50	0.171/0.586
<i>Time</i>	-0.09	-0.16 – -0.01	.025			
<i>Time*Group</i>	-0.06	-0.22 – 0.09	.402			
<i>ECV</i>	-0.01	-0.24 – 0.22	.945			
<i>Time*Group*ECV</i>	0.45	-0.25 – 1.15	.208			
Rumination within-variability						

	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.42	0.36 – 0.48	< .001	0.03, 0.01	0.23	0.174/0.360
<i>Time</i>	0.05	-0.06 – 0.15	.361			
<i>Time*Group</i>	-0.05	-0.26 – 0.16	.621			
<i>ECV</i>	-0.16	-0.43 – 0.10	.228			
<i>Time*Group*ECV</i>	-0.33	-1.29 – 0.63	.499			
Consumption within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.47	0.38 – 0.57	< .001	0.06, 0.03	0.36	0.249/0.517
<i>Time</i>	-0.19	-0.33 – -0.04	.014			
<i>Time*Group</i>	0.23	-0.06 – 0.52	.124			
<i>ECV</i>	0.52	0.11 – 0.93	.013			
<i>Time*Group*ECV</i>	-0.79	-2.15 – 0.57	.250			
Relaxation within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.55	0.48 – 0.63	< .001	0.05, 0.02	0.23	0.143/0.342
<i>Time</i>	-0.18	-0.31 – -0.04	.011			
<i>Time*Group</i>	0.05	-0.22 – 0.31	.734			
<i>ECV</i>	0.15	-0.19 – 0.49	.383			
<i>Time*Group*ECV</i>	0.85	-0.39 – 2.08	.175			
Social Support within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.61	0.54 – 0.68	< .001	0.04, 0.02	0.33	0.082/0.385
<i>Time</i>	-0.01	-0.12 – 0.10	.817			
<i>Time*Group</i>	-0.03	-0.25 – 0.19	.787			
<i>ECV</i>	0.26	-0.04 – 0.57	.090			
<i>Time*Group*ECV</i>	-0.56	-1.60 – 0.47	.283			
Problem-solving within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.43	0.38 – 0.48	< .001	0.03, 0.00	0.09	0.195/0.270
<i>Time</i>	-0.09	-0.20 – 0.02	.097			
<i>Time*Group</i>	-0.24	-0.46 – -0.03	.025			
<i>ECV</i>	-0.03	-0.27 – 0.21	.829			
<i>Time*Group*ECV</i>	0.96	-0.02 – 1.93	.054			
Acceptance within-variability						

	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.39	0.34 – 0.44	< . 001	0.02, 0.01	0.25	0.258/0.442
<i>Time</i>	-0.17	-0.26 – -0.08	.001			
<i>Time*Group</i>	-0.11	-0.29 – 0.07	.225			
<i>ECV</i>	0.01	-0.22 – 0.25	.928			
<i>Time*Group*ECV</i>	-0.10	-0.94 – 0.74	.808			
Expression within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.62	0.53 – 0.70	< . 001	0.04, 0.03	0.42	0.095/0.472
<i>Time</i>	0.08	-0.04 – 0.20	.183			
<i>Time*Group</i>	0.16	-0.09 – 0.40	.208			
<i>ECV</i>	0.34	-0.01 – 0.70	.057			
<i>Time*Group*ECV</i>	-0.89	-2.02 – 0.25	.123			
Suppression within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.48	0.41 – 0.55	< . 001	0.02, 0.02	0.45	0.177/0.546
<i>Time</i>	0.02	-0.07 – 0.11	.686			
<i>Time*Group</i>	0.20	0.02 – 0.39	.029			
<i>ECV</i>	0.02	-0.25 – 0.29	.895			
<i>Time*Group*ECV</i>	-0.60	-1.44 – 0.25	.164			
Avoidance within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.54	0.47 – 0.61	< . 001	0.04, 0.02	0.31	0.181/0.432
<i>Time</i>	-0.19	-0.30 – -0.08	.001			
<i>Time*Group</i>	-0.19	-0.42 – 0.04	.097			
<i>ECV</i>	-0.36	-0.67 – -0.05	.022			
<i>Time*Group*ECV</i>	-0.33	-1.38 – 0.73	.536			

Note. ECV: External Contextual Variability; ICV: Internal Contextual Variability; RMSSD: Root Mean Square of Successive Differences (mean across all strategies).

Table 3

Method 1: Within-strategy variability with Time, Group, and ICV as predictors

Cognitive Reappraisal within-variability						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau00$	ICC	R^2/Ω^2
<i>(Intercept)</i>	0.41	0.36 – 0.46	< . 001	0.02, 0.01	0.26	0.178/0.388
<i>Time</i>	-0.04	-0.13 – 0.05	.402			
<i>Time*Group</i>	-0.05	-0.24 – 0.13	.577			
<i>ICV</i>	0.43	0.03 – 0.82	.034			
<i>Time*Group*ICV</i>	-0.23	-1.83 – 1.36	.772			
Distraction within-variability						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau00$	ICC	R^2/Ω^2
<i>(Intercept)</i>	0.49	0.42 – 0.56	< . 001	0.03, 0.02	0.41	0.216/0.541
<i>Time</i>	-0.06	-0.15 – 0.04	.263			
<i>Time*Group</i>	-0.03	-0.23 – 0.16	.730			
<i>ICV</i>	0.80	0.34 – 1.26	.001			
<i>Time*Group*ICV</i>	-0.48	-2.22 – 1.25	.580			
Tolerance within-variability						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau00$	ICC	R^2/Ω^2
<i>(Intercept)</i>	0.28	0.22 – 0.34	< . 001	0.02, 0.02	0.50	0.107/0.558
<i>Time</i>	-0.03	-0.11 – 0.05	.499			
<i>Time*Group</i>	-0.06	-0.22 – 0.10	.437			
<i>ICV</i>	0.23	-0.15 – 0.61	.233			
<i>Time*Group*ICV</i>	0.87	-0.53 – 2.27	.220			
Self-Support within-variability						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau00$	ICC	R^2/Ω^2
<i>(Intercept)</i>	0.37	0.31 – 0.43	< . 001	0.02, 0.01	0.38	0.103/0.440
<i>Time</i>	-0.07	-0.16 – 0.01	.100			
<i>Time*Group</i>	0.00	-0.17 – 0.18	.969			
<i>ICV</i>	-0.14	-0.53 – 0.26	.497			
<i>Time*Group*ICV</i>	-0.40	-1.92 – 1.12	.603			

Rumination within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.42	0.35 – 0.49	< .001	0.03, 0.02	0.43	0.108/0.496
<i>Time</i>	0.06	-0.04 – 0.16	.269			
<i>Time*Group</i>	0.06	-0.14 – 0.26	.558			
<i>ICV</i>	0.43	-0.04 – 0.90	.069			
<i>Time*Group*ICV</i>	-0.10	-1.86 – 1.66	.908			
Consumption within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.50	0.39 – 0.61	< .001	0.07, 0.05	0.43	0.128/0.506
<i>Time</i>	-0.28	-0.44 - -0.13	.001			
<i>Time*Group</i>	0.06	-0.25 – 0.37	.706			
<i>ICV</i>	0.49	-0.23 – 1.21	.182			
<i>Time*Group*ICV</i>	1.57	-1.16 – 4.30	.254			
Relaxation within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.55	0.47 – 0.63	< .001	0.05, 0.02	0.31	0.159/0.416
<i>Time</i>	-0.14	-0.27 - -0.01	.032			
<i>Time*Group</i>	0.19	-0.07 – 0.45	.144			
<i>ICV</i>	0.23	-0.34 – 0.79	.420			
<i>Time*Group*ICV</i>	-1.47	-3.70 – 0.77	.194			
Social Support within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.61	0.53 – 0.68	< .001	0.04, 0.02	0.34	0.034/0.363
<i>Time</i>	-0.05	-0.16 – 0.07	.417			
<i>Time*Group</i>	-0.04	-0.27 – 0.19	.735			
<i>ICV</i>	0.29	-0.23 – 0.80	.268			
<i>Time*Group*ICV</i>	0.54	-1.46 – 2.55	.591			
Problem-solving within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.42	0.37 – 0.48	< .001	0.03, 0.01	0.14	0.107/0.235
<i>Time</i>	-0.06	-0.17 – 0.05	.256			
<i>Time*Group</i>	-0.10	-0.32 – 0.12	.371			
<i>ICV</i>	0.22	-0.22 – 0.65	.324			

<i>Time*Group*ICV</i>	0.07	-1.79 – 1.93	.941			
Acceptance within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.37	0.31 – 0.43	< .001	0.02, 0.02	0.53	0.302/0.673
<i>Time</i>	-0.16	-0.24 - -0.09	< .001			
<i>Time*Group</i>	-0.07	-0.22 – 0.08	.376			
<i>ICV</i>	0.63	0.27 – 1.00	.001			
<i>Time*Group*ICV</i>	0.53	-0.80 – 1.86	.432			
Expression within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.63	0.55 – 0.72	< .001	0.05, 0.03	0.35	0.032/0.372
<i>Time</i>	0.03	-0.11 – 0.16	.685			
<i>Time*Group</i>	0.09	-0.18 – 0.35	.514			
<i>ICV</i>	0.04	-0.55 – 0.63	.888			
<i>Time*Group*ICV</i>	1.11	-1.19 – 3.41	.338			
Suppression within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.49	0.42 – 0.56	< .001	0.02, 0.02	0.51	0.174/0.592
<i>Time</i>	0.01	-0.08 – 0.10	.826			
<i>Time*Group</i>	0.26	0.08 – 0.44	.005			
<i>ICV</i>	0.06	-0.38 – 0.49	.797			
<i>Time*Group*ICV</i>	0.07	-1.52 – 1.66	.931			
Avoidance within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.53	0.46 – 0.61	< .001	0.04, 0.02	0.35	0.141/0.439
<i>Time</i>	-0.18	-0.30 - -0.07	.002			
<i>Time*Group</i>	-0.11	-0.34 – 0.12	.359			
<i>ICV</i>	0.48	-0.04 – 0.99	.070			
<i>Time*Group*ICV</i>	-0.38	-2.38 – 1.63	.709			

Note. ECV: External Contextual Variability; ICV: Internal Contextual Variability; RMSSD: Root Mean Square of Successive Differences (mean across all strategies).

Table 4

Method 2: Within-strategy variability with Time, Group, and ECV as predictors

Cognitive Reappraisal within-variability						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau00$	<i>ICC</i>	R^2/Ω^2
<i>(Intercept)</i>	0.27	0.20 – 0.34	< . 001	0.06, 0.01	0.11	0.016/0.121
<i>Time</i>	-0.05	-0.20 – 0.11	.532			
<i>Time*Group</i>	-0.15	-0.46 – 0.16	.335			
<i>ECV</i>	0.06	-0.05 – 0.17	.290			
<i>Time*Group*ECV</i>	0.24	-0.37 – 0.86	.440			
Distraction within-variability						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau00$	<i>ICC</i>	R^2/Ω^2
<i>(Intercept)</i>	0.32	0.25 – 0.39	< . 001	0.09, 0.00	0.03	0.012/0.038
<i>Time</i>	-0.05	-0.24 – 0.13	.568			
<i>Time*Group</i>	-0.33	-0.71 – 0.05	.085			
<i>ECV</i>	0.05	-0.08 – 0.19	.430			
<i>Time*Group*ECV</i>	0.61	-0.14 – 1.37	.109			
Tolerance within-variability						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau00$	<i>ICC</i>	R^2/Ω^2
<i>(Intercept)</i>	0.18	0.13 – 0.23	< . 001	0.03, 0.01	0.21	0.017/0.228
<i>Time</i>	-0.02	-0.12 – 0.08	.723			
<i>Time*Group</i>	-0.07	-0.27 – 0.14	.524			
<i>ECV</i>	0.02	-0.05 – 0.10	.558			
<i>Time*Group*ECV</i>	0.06	-0.34 – 0.47	.759			
Self-Support within-variability						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau00$	<i>ICC</i>	R^2/Ω^2
<i>(Intercept)</i>	0.25	0.19 – 0.32	< . 001	0.04, 0.01	0.18	0.016/0.189
<i>Time</i>	-0.14	-0.27 – -0.01	. 041			
<i>Time*Group</i>	-0.08	-0.35 – 0.18	.536			
<i>ECV</i>	0.00	-0.09 – 0.10	.975			
<i>Time*Group*ECV</i>	0.19	-0.34 – 0.71	.487			

Rumination within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.26	0.20 – 0.32	< .001	0.05, 0.01	0.10	0.008/0.107
<i>Time</i>	-0.04	-0.18 – 0.10	.601			
<i>Time*Group</i>	0.00	-0.27 – 0.28	.991			
<i>ECV</i>	0.01	-0.09 – 0.11	.899			
<i>Time*Group*ECV</i>	0.08	-0.47 – 0.63	.769			
Consumption within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.16	0.07 – 0.24	< .001	0.05, 0.03	0.32	0.020/0.337
<i>Time</i>	-0.16	-0.31 – -0.01	.034			
<i>Time*Group</i>	0.23	-0.07 – 0.52	.133			
<i>ECV</i>	0.02	-0.08 – 0.13	.676			
<i>Time*Group*ECV</i>	-0.55	-1.14 – 0.04	.067			
Relaxation within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.20	0.13 – 0.27	< .001	0.07, 0.01	0.06	0.039/0.102
<i>Time</i>	0.00	-0.17 – 0.18	.961			
<i>Time*Group</i>	-0.01	-0.35 – 0.34	.965			
<i>ECV</i>	0.14	0.01 – 0.26	.034			
<i>Time*Group*ECV</i>	0.21	-0.48 – 0.90	.552			
Social Support within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.25	0.16 – 0.34	< .001	0.09, 0.02	0.15	0.012/0.158
<i>Time</i>	0.02	-0.18 – 0.21	.869			
<i>Time*Group</i>	0.06	-0.33 – 0.44	.769			
<i>ECV</i>	0.12	-0.02 – 0.26	.101			
<i>Time*Group*ECV</i>	0.04	-0.73 – 0.82	.909			
Problem-solving within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.23	0.17 – 0.29	< .001	0.05, 0.00	0.08	0.020/0.102
<i>Time</i>	-0.18	-0.32 – -0.04	.014			
<i>Time*Group</i>	-0.02	-0.30 – 0.27	.914			
<i>ECV</i>	0.10	0.00 – 0.21	.044			

<i>Time*Group*ECV</i>	-0.01	-0.57 – 0.55	.973			
Acceptance within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.20	0.14 – 0.26	< .001	0.06, 0.00	0.08	0.048/0.121
<i>Time</i>	-0.15	-0.30 – 0.00	.052			
<i>Time*Group</i>	0.01	-0.29 – 0.31	.949			
<i>ECV</i>	0.16	0.05 – 0.26	.005			
<i>Time*Group*ECV</i>	0.04	-0.56 – 0.64	.893			
Expression within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.16	0.08 – 0.23	< .001	0.06, 0.01	0.15	0.022/0.172
<i>Time</i>	-0.04	-0.19 – 0.12	.663			
<i>Time*Group</i>	-0.03	-0.35 – 0.29	.861			
<i>ECV</i>	0.11	-0.00 – 0.23	.057			
<i>Time*Group*ECV</i>	-0.14	-0.77 – 0.50	.669			
Suppression within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.33	0.26 – 0.39	< .001	0.07, 0.01	0.07	0.021/0.086
<i>Time</i>	-0.03	-0.20 – 0.14	.726			
<i>Time*Group</i>	-0.18	-0.52 – 0.16	.292			
<i>ECV</i>	-0.04	-0.17 – 0.08	.475			
<i>Time*Group*ECV</i>	0.62	-0.05 – 1.30	.070			
Avoidance within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.28	0.20 – 0.36	< .001	0.07, 0.02	0.22	0.023/0.237
<i>Time</i>	-0.06	-0.22 – 0.11	.502			
<i>Time*Group</i>	-0.01	-0.34 – 0.32	.960			
<i>ECV</i>	0.01	-0.11 – 0.13	.877			
<i>Time*Group*ECV</i>	0.07	-0.59 – 0.73	.836			

Note. ECV: External Contextual Variability; ICV: Internal Contextual Variability; RMSSD: Root Mean Square of Successive Differences (mean across all strategies).

Table 5

Method 2: Within-strategy variability with Time, Group, and ICV as predictors

Cognitive Reappraisal within-variability						
	Estimates	95% CI	<i>p</i> value	$\sigma^2, \tau00$	<i>ICC</i>	R^2/Ω^2
<i>(Intercept)</i>	0.30	0.26 – 0.34	< . 001	0.06, 0.01	0.09	0.054/0.136
<i>Time</i>	-0.01	-0.07 – 0.04	.594			
<i>Time*Group</i>	-0.08	-0.19 – 0.02	.118			
<i>ICV</i>	0.20	0.07 – 0.32	.002			
<i>Time*Group*ICV</i>	0.13	-0.48 – 0.74	.670			
Distraction within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.34	0.30 – 0.38	< . 001	0.09, 0.00	0.03	0.014/0.046
<i>Time</i>	-0.00	-0.06 – 0.06	.979			
<i>Time*Group</i>	-0.06	-0.18 – 0.06	.341			
<i>ICV</i>	0.19	0.04 – 0.34	.015			
<i>Time*Group*ICV</i>	-0.10	-0.83 – 0.63	.789			
Tolerance within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.19	0.15 – 0.23	< . 001	0.03, 0.01	0.21	0.022/0.229
<i>Time</i>	-0.04	-0.08 – -0.01	.018			
<i>Time*Group</i>	-0.04	-0.10 – 0.03	.300			
<i>ICV</i>	-0.01	-0.09 – 0.08	.887			
<i>Time*Group*ICV</i>	0.02	-0.38 – 0.42	.931			
Self-Support within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.25	0.21 – 0.29	< . 001	0.04, 0.01	0.16	0.029/0.180
<i>Time</i>	-0.06	-0.10 – -0.01	.011			
<i>Time*Group</i>	-0.01	-0.10 – 0.08	.854			
<i>ICV</i>	0.07	-0.04 – 0.18	.193			
<i>Time*Group*ICV</i>	0.02	-0.50 – 0.53	.954			
Rumination within-variability						

	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.27	0.23 – 0.30	< .001	0.04, 0.01	0.11	0.028/0.138
<i>Time</i>	-0.05	-0.09 – -0.00	.042			
<i>Time*Group</i>	0.04	-0.05 – 0.13	.431			
<i>ICV</i>	0.11	0.01 – 0.22	.040			
<i>Time*Group*ICV</i>	-0.32	-0.85 – 0.21	.232			
Consumption within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.17	0.10 – 0.24	< .001	0.05, 0.03	0.33	0.008/0.334
<i>Time</i>	-0.04	-0.09 – 0.01	.119			
<i>Time*Group</i>	-0.01	-0.11 – 0.09	.826			
<i>ICV</i>	0.08	-0.04 – 0.20	.194			
<i>Time*Group*ICV</i>	-0.16	-0.74 – 0.41	.574			
Relaxation within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.26	0.22 – 0.29	< .001	0.07, 0.00	0.05	0.035/0.085
<i>Time</i>	0.10	0.04 – 0.16	.001			
<i>Time*Group</i>	0.07	-0.04 – 0.19	.221			
<i>ICV</i>	0.06	-0.09 – 0.20	.440			
<i>Time*Group*ICV</i>	0.25	-0.43 – 0.92	.475			
Social Support within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.30	0.24 – 0.36	< .001	0.09, 0.02	0.16	0.015/0.169
<i>Time</i>	0.03	-0.03 – 0.10	.317			
<i>Time*Group</i>	0.03	-0.10 – 0.16	.656			
<i>ICV</i>	0.18	0.03 – 0.34	.023			
<i>Time*Group*ICV</i>	-0.11	-0.85 – 0.64	.782			
Problem-solving within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.29	0.25 – 0.32	< .001	0.05, 0.00	0.09	0.030/0.117
<i>Time</i>	-0.04	-0.09 – 0.00	.064			
<i>Time*Group</i>	-0.01	-0.11 – 0.08	.810			
<i>ICV</i>	0.18	0.06 – 0.29	.003			
<i>Time*Group*ICV</i>	0.25	-0.30 – 0.81	.369			
Acceptance within-variability						

	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.27	0.24 – 0.31	< .001	0.06, 0.01	0.09	0.053/0.134
<i>Time</i>	-0.11	-0.16 – -0.06	< .001			
<i>Time*Group</i>	-0.00	-0.10 – 0.10	.948			
<i>ICV</i>	0.20	0.08 – 0.32	.001			
<i>Time*Group*ICV</i>	0.25	-0.33 – 0.83	.399			
Expression within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.21	0.16 – 0.26	< .001	0.06, 0.01	0.14	0.028/0.163
<i>Time</i>	0.07	0.01 – 0.12	.016			
<i>Time*Group</i>	-0.07	-0.18 – 0.03	.177			
<i>ICV</i>	0.13	0.00 – 0.26	.043			
<i>Time*Group*ICV</i>	-0.03	-0.66 – 0.59	.920			
Suppression within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.29	0.26 – 0.33	< .001	0.07, 0.00	0.04	0.018/0.060
<i>Time</i>	0.03	-0.02 – 0.09	.256			
<i>Time*Group</i>	0.08	-0.03 – 0.19	.154			
<i>ICV</i>	0.11	-0.03 – 0.25	.117			
<i>Time*Group*ICV</i>	-0.26	-0.92 – 0.41	.447			
Avoidance within-variability						
	Estimates	95% CI	<i>p</i> value			
<i>(Intercept)</i>	0.28	0.22 – 0.33	< .001	0.07, 0.01	0.18	0.022/0.196
<i>Time</i>	-0.09	-0.14 – -0.03	.002			
<i>Time*Group</i>	-0.03	-0.17 – 0.10	.645			
<i>ICV</i>	-0.03	-0.17 – 0.10	.645			
<i>Time*Group*ICV</i>	0.47	-0.18 – 1.12	.156			

Note. ECV: External Contextual Variability; ICV: Internal Contextual Variability; RMSSD: Root Mean Square of Successive Differences (mean across all strategies).

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UNIVERSITY EDUCATION

- **2020 – 2023:** PhD student in Clinical psychology, LIP/PC2S, Université Grenoble Alpes. Supervisors: Catherine Bortolon & Céline Baeyens.
- **2018 – 2020:** Master in Clinical Neuropsychology and Cognitive Psychopathology, Université Paul Valéry, Montpellier III.
- **2015 – 2018:** Licence in Clinical Psychology, Université Paul Valéry, Montpellier III.
- **2013 – 2015:** Licence in English language, literature and civilisation, Université Paul Valéry, Montpellier III.

Complementary trainings:

- **2023:** Unified Protocol for Emotional Disorders Barlow – PsyLink: Linda Kempe & Pierluigi Graziani
- **2023:** JsPsych – LIP/PC2S
- **2021:** Compassion focused Therapy – Association PPSY
- **2021:** Certification in Good Clinical Practices of Research – Centre Hospitalier Universitaire Grenoble Alpes
- **2020:** Motivational interview – Hôpital de Jour Les Hauts de Massane (A. Deconnor)

RESEARCH ACTIVITIES

Publications:

- **Nardelli, C., Montreuil, T., Naoufal, M., Berking, M., Baeyens, C., Bortolon, C.** (2023). French validation of the Emotion Regulation Skills Questionnaire (in press in the *European Review of Applied Psychology*) (SJR 2022: 0.24, Q4).
- **Nardelli, C., Baeyens, C., Bortolon, C.** (submitted to *Cognition and Emotion*). A Systematic review on experimental and daily measures of emotion regulation flexibility.
- **Nardelli, C., Holtzmann, J., Nuel, I., Baeyens, C., Bortolon, C.** (in prep). REFLEX: A randomized controlled trial to test the efficacy of an emotion regulation program on flexibility and mental health.
- **Nardelli, C., A. Bonanno, G., Chen, S., Bortolon, C.** (in revision in the *British Journal of Clinical Psychology*). Emotion regulation flexibility and psychosis: a longitudinal study disentangling components of flexibility in psychosis-proneness.

- **Nardelli, C.**, Paucsik, M., Weiner, L., A. Bonanno, G., Bortolon, C. (in submission). French validation of the Context-Sensitivity Index (CSI) and the Flexible Regulation of Emotional Expression scale (FREE).
- **Nardelli, C.**, Rolland-Carlichi, E., Bortolon, C. (2023). Emotion regulation choice and Psychosis Proneness: a replication and extension study. *Collabra: Psychology*, 9(1). <https://doi.org/10.1525/collabra.73755> (SJR 2022: 1.169, Q1).
- **Nardelli, C.**, Battaglini, A., Van der Eeden, W., LeMoult, J., Bortolon, C. (in prep). Emotion regulation choice in context.
- Paucsik, M., **Nardelli, C.**, Bortolon, C., Shankland, R., Leys, C., & Baeyens, C. (2022). Self-compassion and emotion regulation: testing a mediation model. *Cognition and Emotion*, 1-13. <https://doi.org/10.1080/02699931.2022.2143328> (SJR 2021: 1.121, Q1).
- Brand, R. M., Altman, R., **Nardelli, C.**, Raffoul, M., Matos, M., & Bortolon, C. (2022). Echoes of shame: a comparison of the characteristics and psychological sequelae of recalled shame experiences across the voice hearing continuum. *Behavioural and Cognitive Psychotherapy*, 1-13. <https://doi.org/10.1017/S1352465822000418> (SJR 2021: 0.781, Q2).
- **Nardelli, C.** (2023) – *Journal Club, Nature Review Psychology*. <https://doi.org/10.1038/s44159-023-00237-1>

Reviewing:

- *Journal of Behavioural and Cognitive Therapy* – Haymoz et al., 2021.
- *Motivation and Emotion - Compassionate Goals Predict Greater Helping through a Nonzero-sum Mindset* (2023)
- *Frontiers in Psychology* – Shilon et al., 2023

Master theses:

- Master 2: *Shame memories, intrusive thoughts and unusual perceptions in the general population* – Catherine Bortolon & Stéphane Raffard (Université Paul Valéry)
- Master 1: *Grandiose ideas, shame and self-esteem* – Catherine Bortolon & Stéphane Raffard (Université Paul Valéry)

Material translations:

- Participation to the French translation: Berking, M. & Whitley, B. *Affect Regulation Training: A Practitioners' Manual*.
- Participation to the French translation: *Soutenir un membre de sa famille atteint de Schizophrénie*, Kim Mueser et al., 2017.

TEACHING EXPERIENCES

- 2022-2023: CM Adult Psychopathology – L2 (24HTD)
- 2021-2022: CM Adult Psychopathology – L2 (36HTD)
- 2021-2022: CM Psychopathology – L3 (4,5HTD)
- 2021-2022: TD Experimental Data Analysis and Interpretation – L2 (8HTD)
- 2021-2022: TD Clinical treatments – L2 (4HTD)
- 2021-2022: CM Psychology of Emotions – L2 (3HTD)
- 2020-2021: TD Experimental Data Analysis and Interpretation – L2 (16HTD)

SUPERVISION EXPERIENCES

Masters – Supervised Research

- 2022-2023: Laura Ybert – Interventional study REFLEX; Romain Ginoux – French validation
- 2021-2022: Jeanne Ecochard & Léa Gilliet – Experimental study
- 2019-2020: Emma Guerrero, Louise Cascino, Louisa Taillet & Ihissane M’Faloumé – Experimental study

Interns’ supervision – Research in clinical psychology

- 2022-2023: Ambre Tortorella (L2), Manuela Peirera (M2)
- 2021-2022: Léna Boursier, Nanou Clément, Erwan Collin (L2), Emma Rolland-Carlichi (M2)
- 2020-2021: Camille Cellier (L2)

COMMUNICATIONS

Oral:

1. **Nardelli, C., Holtzmann, J., Nuel, I., Baeyens, C., Bortolon, C. (in prep).** REFLEX - A randomised controlled trial to test the efficacy of an emotion regulation program. *European Congress of Psychology 2022*, Ljubljana, Slovénie.
2. **Nardelli, C., Montreuil, T., Naoufal, M., Berking, M., Baeyens, C., Bortolon, C. (2022).** Validation française du questionnaire de compétences de régulation émotionnelle. *3^e Colloque francophone de pratiques en TCC 2022*, Louvain-La-Neuve, Belgique.
3. **Nardelli, C., Holtzmann, J., Nuel, I., Baeyens, C., Bortolon, C. (in prep).** REFLEX - A randomized controlled trial to test the efficacy of an emotion regulation program. *Colloque AFFORTHEC/DIU TCC 2023*. Chambéry, France.
4. **Nardelli, C., Bortolon, C. (2023).** Emotion regulation flexibility. *Pint of Science Grenoble 2023*.
5. **Nardelli, C. (2023).** Emotion regulation. *PPSY workshop, 2023*.

Posters:

1. **Nardelli, C., Montreuil, T., Naoufal, M., Berking, M., Baeyens, C., Bortolon, C. (2022).** French validation of the Emotion Regulation Skills Questionnaire. *Congrès AFTCC Décembre 2021*. Paris, France.
2. **Nardelli, C. Holtzmann, J., Nuel, I., Baeyens, C., Bortolon, C. (in prep).** REFLEX: A Randomised Controlled Trial to test the efficacy of an emotion regulation program. *BABCP Annual Conference 2023*. Cardiff, Pays de Galles.

CLINICAL EXPERIENCES

- **Affect Regulation Training groups – Psychologist (REFLEX study)**
- **University Department of Adult Psychiatry (CHU La Colombière – Montpellier) - Intern**
Neuropsychological examinations, Behavioural Activation treatment, group for obsessive-compulsive disorders, Home-based interventions for OCD and Schizophrenia
- **EHPAD - Intern**
Neuropsychological tests and patients care
- **Neurology, Neurosurgery, Intensive Care Department (CHU Gui de Chauliac – Montpellier) - Intern**
Neuropsychological tests and patients care

Complementary Activities

- Member of the association PPSY – Promote psychotherapies
- InDoc – Friedrich-Alexander University – Erlangen
- Organisation *Rencontre Jeunes Chercheurs 2022 & 2023*
- Jury member – Journée de la Psychologie Positive 2022
- Jury member for Master 1 psychology students.