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POTENTIAL MECHANISMS UNDERLYING REAPPRAISAL STRATEGIES: AN EXPLORATORY STUDY

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Abstract

Reappraisal strategies are vital for our psychological well-being. The way people feel, behave and react in different stressful situations, depends to a degree on the reappraisal strategies they use to manage their emotional states and to cope with a given situation. In this paper, we assess the types of reappraisal strategy described in the scientific literature from the point of view of a focus on specific cognitive strategies. Adopting a mixed research design, we used inductive content analysis in order to identify potential underlying mechanisms relating to qualitative patterns of thinking used in efficient reappraisal. Eight anger and anxiety eliciting situations where used to stimulate emotional responses and the use of reappraisal strategies. Based on our exploratory approach we identified four additional specific reappraisal strategies (justification, responsibly assumption, normality check, and non-justified acceptance) which can be used as specific intervention techniques. Awareness and core beliefs are cognitive processes that contribute to the understanding of inter-individual differences in the efficacy of the reappraisal process. Research areas for future studies are identified.

Keywords: reappraisal, emotional self-regulation, cognitive strategies, awareness.

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Cognitive reappraisal is a method for viewing an emotionally evocative event from a different perspective and for reinterpreting its meaning, in order to change its emotional impact (Fink et al., 2017; Ford & Troy, 2019; Lazarus & Alfert, 1964; Lazarus & Folkman, 1984; Newman & Nezlek, 2021; Perchtold et al., 2019).

Cognitive Reappraisal has been shown to be effective in more than just changing self-reported emotional experience (Hajcak et al., 2010, Ochsner & Gross, 2008, Sai et all. 2015). More specifically, it can play a role in the reduction of peripheral physiology and of brain activity associated with a variety of mental health problems, such as addiction, impulse control, schizophrenia and depression (Baur et al., 2015; Demaree et al., 2004; Foti & Hajcak, 2009; Kamburidis, 2024; Koob & Le Moal, 2001; Pavlov et al., 2014; Sai et al., 2015). In this way it could be one of the most important strategies used for emotional regulation (Sai et al., 2015).

As research by Perchtold et al., (2019) suggests, not all reappraisal strategies show the same efficacy level in changing dysfunctional emotional responses into adaptive responses. Furthermore, it has been hypothesized that not all forms of cognitive reinterpretation are beneficial. With regard to this McRae et al., (2012) state that in order to identify the difference in the efficacy and the emotional outcomes of the reappraisal strategies used by subjects there is a need to take the following three criteria into account: (a) the main goal of the reappraisal strategies (increasing positive versus decreasing negative emotions); (b) the reappraisal tactics used to challenge reality; and (c) the extent to which the effect on regulating emotions is dependent upon changes in the first two criteria. Previous studies have demonstrated that an increase in the frequency of the use of reappraisal strategies can increase a subject's well-being (Deplancke et al., 2022; Ford et al., 2017; Newman & Nezlek, 2021). These results do not offer a clear perspective on the underlying cognitive mechanism. Ford & Troy (2019) formulated a conceptual framework that identified some drawbacks in current research, and recommended directions for future research, two of which focused on identifying the mechanisms that are responsible for inter-individual differences, and on designing interventions that best assist individuals in stressful situations.

According to Brans and Verduyn (2014), in order to have a better understanding of emotional experience in specific situations, it is necessary to establish both the nature of an emotion and also its intensity and its duration (Verduyn et al., 2009; Verduyn et al., 2012). Verduyn et al. suggest that this approach could be useful, even in cases of self-reported assessment. In more specific terms, the use of discrete emotional categories (such as anger, fear, etc.) as well as non-discrete emotional dimensions (such as valence and arousal) (Betella & Verschure, 2015; Marchewka et al., 2013; Riegl et al., 2015) could contribute to our understanding of the differences in emotional response in different reappraisal strategies.

Studies on the influence of reappraisal strategies on recalling and recognising emotionally loaded stimuli or events (Erk et al., 2010; Wang et al.,

2017), can be seen as demonstrating indirect long term benefits from the habitual use of reappraisal strategies. More specifically, Wang et al. (2017) show that up-regulation and down-regulation cognitive reappraisal strategies increase performance in recalling explicit memories of the emotional content of stimuli without specifying the level of emotional re-experience. Erk et al. (2010) concluded that memory for emotionally encoded stimuli is explained by emotional re-activation, whereas memory for items successfully encoded during emotion regulation is explained by recognition of features and cognitive content, suggesting that the level of cognitive processing of emotional stimuli could contribute to (a) a lower level of re-activation of the emotion eliciting memories, and (b) could increase the efficacy of a long term of change in beliefs at a higher level of generality. This would decrease the level of re-activation of emotional responses to stimuli for which reappraisal was used during the time of encoding. From this perspective, the emotional outcome of reappraisal strategies could be due to (a) the direct effect of challenging the cognitive content, and (b) the influence of mediated thought on other cognitive processes, such as attention and memory.

In our study we aim to identify whether there are cognitive dimensions or mechanisms that have been missed when attempting to understand the difference in efficacy level when changing a dysfunctional emotional response into an adaptive response. As an initial step we review the specific criteria used in the scientific literature to categorize different reappraisal strategies.

Similarities between reappraisal strategies

Different studies and different authors tend to use different criteria to categorise reappraisal strategies (Bintaş-Zörer & Yorulmaz, 2021). There are studies which are focus only on a particular reappraisal strategy, such as using a humorous perspective in an aversive situation (Fink et al., 2017; Perchtold et al., 2019). Other researchers offer an exhaustive categorisation of reappraisal strategies (Gross and Thompson, 2007; McRae et al., 2012; Webb, et al., 2012). There are many similarities and differences which can be found between different categories. Firstly, we propose to identify the similarities.

Changes in how we think about the situation.

From the definition or reappraisal strategies we can already expect a level of reinterpretation of aversive events. We identified three ways in which the authors that offer a complex description of reappraisal strategies focused on the event show similarities:

A. Normality - One overlap between the meta-analysis of Webb et al. (2012) and the reappraisal tactics coding guide proposed by McRae et al. (2012) is that the reappraisal of an emotional response or aversive event is seen as a normal part of living. McRae et al. (2012) focused on categorising reappraisal strategies as

thought processes, describe this category as *acceptance* (including aversive events as stimuli), while Webb, et al. (2012) focused on describing the object of the reappraisal by the use of the term *reappraisal of the emotional response.* Some more recent studies suggest that reappraisal strategies that have a clear correspondence with the client's real life experiences are the only ones that offer clear replicability of their effects in changing positive and negative emotional states (Brockman et al., 2023, Wang & Yin, 2023)

B. Diminution of negative evaluation - reinterpretation of the emotional stimuli, events or suffering in a way that suggests that things are not as bad as they seem, that there could be positive outcomes, or which serve to remind us that we can't predict the future are all included in a single category by Gross and Thompson (2007); Webb, et al. (2012). However, these are divided into three different categories by McRae et al. (2012).

C. Humoristic and negation - Fink et al. (2017), Nook et al. (2020) and Papousek et al. (2019) describe multiple humoristic strategies based on their linguistic style, such as metonymy, metaphor, polysemy and so on. All of these function as ways of distancing oneself from aversive events. The idea of distancing or negation is also described by McRae et al. (2012), alongside two reappraisal strategies, reality challenging and distancing, which involve the idea that the events which occur or that the emotional loaded stimuli are not real or authentic, or that they are something other than they appear to be. Nook et al. (2020) discuss the role of linguistic markers as demonstrating the subjects spatial, social and temporal distancing from a potentially aversive event, such as the replacement of first person pronouns with third person pronouns. They suggest that there is a bi-directional relationship between reappraisal and linguistic distancing.

Perspective taking in a situation

These reappraisal strategies focus on changes in the way a situation is viewed **(**Gross and Thompson, 2007; McRae et al., 2012; Papousek et al., 2019; Webb, et al., 2012), and on the ways the impact of an emotional stimulus is altered by adopting a more or a less objective perspective. It is possible for a person to imagine themself as objectively placed with regard to a situation, or they can view the stimulus from the perspective of an external observer, or see it as a fantasy, or from the point of view of a narrator.

Differences between reappraisal strategies

The degree of generalisation in the description of reappraisal strategies by different authors differs significantly, but there is also a lack of overlap between them. Consequently, in the following we describe the reappraisal categories that are presented by only some of the writers in this field.

Problem solving

A major difference between authors is that it is only McRae et al. 2012 who describe reappraisal as the assessment of the capacity to cope with a specific situation, as a form of problem solving, and as a thinking strategy, and places two different reappraisal strategies in this category. The first strategy, Technical-Analytic-Problem Solving, (McRae et al., 2012), focuses on internal resources, while the second strategy, Agency, focuses on external resources (McRae et al., 2012). One possible reason why some authors such as Lennarz et al. (2018) do not include problem solving in the category of reappraisal strategy may be that they define this as an emotional regulation strategy, which they see as an entirely different kind of strategy.

Variety in operationalisation of reappraisal strategies

In the literature, reappraisal strategies are described in a variety of ways, from strategies such as: (a) reappraisal attempts and reappraisal successes (Ford et al.,2017; Ford & Troy, 2019); (b) reappraisal frequency, repertoire, context sensitivity and feedback loop (Bonanno & Burton, 2013); (c) reappraisal fluency and reappraisal flexibility (Zeier et al., 2019); (d) automatic and controlled reappraisal processes (Sheppes et al., 2014); and studies which restrict the reappraisal strategies used by their subjects in order to assess their efficacy (Koenigsberg et al.,2010, Ochsner et al., 2004, Papousek et al., 2019). All these studies (see table 1) have an important contribution to make but are limited when it comes to offering a comprehensive view of the underlying mechanisms of reappraisal strategies that contribute to differences in outcome.

Table 1. Synthesis of the reappraisal categories definitions

	Similarities			Differences	
Study	Normality	Diminution of negative evaluation	Humouristic, linguistic and negation	Problem Solving	*Variate general definitions*
McRae et al., (2012)	Acceptance	Change Current Circumstances. Change future Consequences, Explicit Positive	Reality Challenge, Distancing	Technical-Analytic-Problem Solving as a reappraisal strategy	Agency is a reappraisal strategy focused outside help
Papousek et al., (2019)	Different World of Experience		Metonymy, Metaphor, Polysemy, Word Play, Fantasy and Fiction, Narrative		

	Similarities			Differences	
Study	Normality	Diminution of negative evaluation	Humouristic, linguistic and negation	Problem Solving	*Variate general definitions*
			Change of Perspective		
Nook et al., (2020)			third person pronouns		
Gross and Thompson (2007), Webb, et al., (2012)	Reappraisal of the emotional response, Perspective taking	Reappraise emotional stimulus			Reappraisal mixed
Lennarz et al., (2018)	Acceptance	Reappraisal	Distractions, avoidance, suppression	reappraisal, acceptance and problem solving different emotional regulation strategies	Social support
Bonanno & Burton, 2013					frequency, repertoire, context and feedback
Sheppes et al., 2014					automatic and controlled reappraisal process
Zeier et al., 2019					appraisal fluency and reappraisal flexibility
Ford et al., 2017; Ford & Troy, 2019					reappraisal attempt and reappraisal success

The cells include the name of the reappraisal categories described by the different authors.

The approach, proposed by McRae et al. (2012), and Webb et al. (2012), adopts a more complex way of categorising reappraisal strategies. While the categorisation of reappraisal strategies offered by Webb et al. (2012) focuses

predominately on the object of the reappraisal (event, emotional response), McRae et al. (2012) use guidelines for coding reappraisal tactics, as is shown in table 1. The authors identify differences in emotional outcomes at the content/semantic level, dependent upon the goal of the subject's increase in positive emotions, rather than a decrease in negative emotions.

The categorization used by McRae et al. (2012), in order to code the answers of the participants, use criteria that best express the underlying cognitive strategies and changes in cognitive content, when compared with the other types of categorization. The limitation of this approach is that this way of categorizing, used as a standard way of classifying the answers of participants, implies that reappraisal strategies, which could be better described by cognitive mechanisms that fall outside McRae's categorisation, could be assigned to one of these standard categories. A second limitation is the possibility that different categories could overlap, such as present as opposed to future consequences in the case of situation based change. The underlying criteria for categorization used can be analysed as (a) valence - positive versus negative, (b) timing - present versus future, and (c) subject - situation based versus emotion based.

All these above-mentioned limitations can be translated into difficulties in developing the most efficient interventions to prevent or diminish possible mental health problems which are related to limited emotion regulation abilities. The principal reason for variations in reappraisal effects on well-being could be due to the multidimensionality of factors involved, which include such things as beliefs (Deplancke et al.,2022), the number of daily life events (Newman & Nezlek, 2021), and the discrepancy between attempts at reappraisal and the successful implementation of reappraisal strategies (Ford et al., 2017). The potential mechanisms underlying the differences in efficacy of reappraisal strategies are well covered by the literature (Brockman et al., 2023, Cohen Ben Simon et al., 2022, Wang & Yin, 2023) but are often not included in studies that try to explore the differences in the efficacy of reappraisal strategies. In so far as reappraisal strategies are not well defined, it is important to distinguish between the variations in the effectiveness of reappraisal based training/interventions which are due to inter-individual differences and those which are due to differences in applied reappraisal strategies.

Purpose of the present study

Our exploratory study had as its principal aim the identification of potential mechanisms underlying reappraisal strategies (Brockman et al., 2023, Cohen Ben Simon et al., 2022, Wang & Yin, 2023). More specifically, our aim was to identify and define reappraisal strategies and the possible underlying cognitive mechanisms which can be effectively used as techniques in self-regulation training intervention. The questions that our study aimed to answer were: (a) are specific

reappraisal strategies well enough defined in the scientific literature to allow them to be use in training programs; and (b) what cognitive process are activated during the reappraisal process that can influence emotional outcomes.

Based on the earlier findings and on our research goals, we used a mixed research design: (a) inductive content analysis with the goal of identifying possible missing underlying reappraisal mechanisms; and (b) the measurement of pre- vs. post-intervention emotional responses (non-discrete and discrete measurement of emotion) in order to verify the efficacy of the reappraisal strategies that emerged. We expected that the level of discrete and non-discrete negative emotion would be significantly lower in the post-reappraisal phase. (Bonanno & Burton, 2013; Deplancke et al., 2022; Fink et al., 2017; Ford et al., 2017; Lazarus & Alfert, 1964; Lazarus & Folkman, 1984; Newman & Nezlek, 2021; Perchtold et al., 2019; Sai et al., 2015; Scult et al., 2016; Sheppes & Gross, 2010; Sheppes et al., 2012).

Method

Participants

Our sample consisted of 24 subjects from Romania from a variety of occupational backgrounds (executive directors, managers, a medical assistant, a make-up artist, a teacher, a freelancer, a student, a salesperson, an accountant, a housewife, a chef, a factory-worker, and a cashier) with a mean age of 33.0 years (19-56 years, *SD* = 10.3, 79.2 % female). The subjects were Romanian, Hungarian and German. 37.5 % were married, 4.2 % engaged to be married, 16.7 % divorced or widowed, and 41.7 % were neither married nor engaged to be married, nor divorced nor widowed. The participants educational background was as follows: 62.5% had completed high-school; 8.3% had a bachelor's degree; and 29.2% had a master's degree. We tested the saturation of the sample size using the code meaning method (Hennink & Kaiser, 2022), and the sample reached saturation at 12 subjects. Participants volunteered for the study, and no incentives for participation were offered. Data was collected between November 2020 and March 2021. An information sheet and a consent form were included at the beginning of the study. The participants were informed that they could decide not to answer questions and could withdraw at any time, and that the information collected was confidential and would be used solely for the present study. Approval for the project was obtained from the appropriate review committees at the authors' institutions. The group was selected so as to include members of the general population with no previous history of mental health problems. We used as a criterion for inclusion, that the subjects be active healthy subjects from a wide range of backgrounds. We excluded from the study anyone with a previous diagnosis of depression, anxiety or any other

psychopathology. The participants were recruited using an invitation email sent to an email list of university students and graduates.

Measures

Emotional response

We used the self-assessment method described by Riegl et al. (2015), (Betella & Verschure, 2015; Marchewka et al., 2013). Discrete emotional categories (joy, anger, fear, disgust, pity, sadness and surprise) were measured using a 5 point Likert scale (from 1- absent to 5- high). Non-discrete emotional dimensions (valence, arousal, approach) were measured using a 5 point Likert scale (where the value 3 was the neutral value between the two extremes, for example, between negative and positive in the case of valence).

Reappraisal strategies

We used the Reappraisal Inventiveness Test (RIT) developed by Weber et al. (2013). RIT is a way of measuring reappraisal strategies by using four anger eliciting vignettes (Weber et al., 2013) and four anxiety eliciting vignettes (de Assuncao et al., 2015; Perchtold et al., 2019) which present subjects with the kinds of emotion eliciting situations that can occur in everyday life. The vignettes were adapted, first by enhancing the original description of every situation with sensory clues (Andrade et al., 2012; Schifferstein, 2009) in order to facilitate the process of identifying and imagining the aversive situation. Second, we replaced some locations or details to make them easier for a broader population to relate to. For example: the original vignette (Weber et al., 2013) is as follows: *Kitchen. You invite friends over for a meal, but when you step into the kitchen of your home (instead of flat), the entire kitchen is full of dirty dishes, looks dingy and unpleasant, and there is a smell of onions and other unpleasant food smells (instead of is a mess). Yesterday, your partner (instead of flatmate) had promised to clean up the kitchen by today. When you go to talk to your partner, he/she tells you that he/she is watching TV and doesn't feel like cleaning up.* A picture, which illustrated the main theme of the vignette, accompanied each vignette. For example, for the situation in which the person is contacted by a doctor for further tests, a picture of a doctor was included.

Procedure

The data was collected online using google meets, in order to record the audio/video call, after the participants had provided their email addresses and indicated their availability. In order to undertake an inductive content analysis, the content of the recordings was transcribed. Demographic information was collected from participants who agreed to the use of their data in accordance with research specific legal regulations.

The questions that our study aimed to answer are: (a) are specific reappraisal strategies well enough defined in the scientific literature to allow them to be used in training programs; and (b) what cognitive process are activated during the reappraisal process that can have an effect on emotional outcomes. By starting with these questions, an exploratory mixed research design emerged as the optimal research approach. The inductive content analysis was conducted by the authors. In the first instance, we used the McRae et al. (2012) reappraisal tactic coding guide as a basis. We analysed the similarities and differences between the reappraisal categories used in our study and those used by McRae et al. (2012). We aimed to identify categories which had not been included with a view to showing how they could be transformed into specific intervention techniques. Secondly, we aimed to identify cognitive processes that might possibly be present and which could impact on the use of reappraisal strategies (Brockman et al., 2023, Cohen Ben Simon et al., 2022, Wang & Yin, 2023). In order to validate the possible reappraisal strategies which we identified, we measured the changes in emotional responses. We used the code meaning method described by Hennink and Kaiser (2022) and inductive content analysis. The fact that after 12 subjects the authors did not find any new reappraisal strategies suggested that the saturation point of possible reappraisal strategies had been reached.

For each vignette/emotion evoking situation data was collected in three stages, as follows: (a) subjects were instructed to read the vignette aloud and to imagine the situation happening to them. They were then asked to assess their emotional response by selecting a field from the form provided; (b) the subjects were then asked to try to think of and describe out loud as many ways as possible of appraising the specific situation in ways which diminished their negative emotions; and (c) the subjects were asked to reassess their emotional response to the situation, and the content of the vignette was displayed again so that it could be read again (Perchtold et al., 2019; Weber et al., 2013). A google form was used during the video call to record the pre- and post-reappraisal task assessments of their emotional responses.

Statistical Analysis

Descriptive analyses were conducted with JAMOVI. In order to determine and test the relationship between the variables we used the following calculations and statistical tests (to a 95 % Confidence Interval): (a) Descriptive statistics; and (b) the Wilcoxon test for paired samples pre- vs post-self-regulation comparison test. The Wilcoxon test was used in order to compare the pre- and post-intervention emotional responses, based on the non-parametric characteristics of our results.

Results

We tested the normality of the distributions for all the measurements of emotion responses. The results of the Shapiro-Wilks test indicated that the distributions of the emotional response variables did not approximate a normal distribution, (p = <.001). As follows, we decided to use non-parametrical comparison tests.

Non-discrete emotional response

Comparing the emotional responses operationalized through non-discrete measurements obtained between the first and third steps of our study, before and after the reappraisal task, we obtained statistically significant changes in the level of valence (Wilcoxon *W* anger = 92.0 p<.001, *Cohen d* = -0.909; *W* anxiety = 116.5 p<.001, *Cohen d* = -0.713), arousal (Wilcoxon *W* anger = 2536.0 p<.001, *Cohen d* = 1.012; *W* anxiety = 2248.5 p<.001, *Cohen d* = 0.792) and approach (Wilcoxon *W* anger = 621.0 p = .004, *Cohen d* = 0.298; *W* anxiety = 158.0 p = 0.045, *Cohen d* = -0.211) for both anger and anxiety electing situations, with a higher effect value for arousal and valence. This exploratory approach suggest that the reappraisal strategies applied by the subjects were effective in changing their emotional states.

Discrete emotional Response

Table 2 shows that the main differences between pre- and post-intervention results with regard to the anger and anxiety vignettes consisted in values that are not statistically significant. In the case of anger eliciting situations, the pre-/post-intervention comparison did not show statistically significant differences for pity (Wilcoxon *W* pity = 220.5, p = .693, *Cohen d* = 0.0309, m^{T1} = 1.66; m^{T2} = 1.63), and showed the lowest effect size for fear (*Cohen d* = 0.2268). In the case of anxiety eliciting situations, the pre-/post-intervention comparison did not show statistically significant differences for disgust (Wilcoxon *W* fear = 284.5, p = .147, *Cohen d* = 0.303; m^{T1} = 1.59; m^{T2} = 1.42).

Table 2. Comparison between pre- and post-reappraisal tasks for anger and anxiety eliciting vignettes

	Paired Samples Wilcoxon-Test						
	Pre		Post				
	M	*SD*	*M*	*SD*	*W*	*p*	*Cohen's d*
joy A	1.52	0.882	2.46	1.436	88.0[a]	<.001	-0.7100

Paired Samples
Wilcoxon-Test

	Pre		Post				
	M	*SD*	*M*	*SD*	*W*	*p*	*Cohen's d*
anger A	3.11	1.391	1.77	1.110	2593.5[b]	<.001	1.0115
fear A	1.51	0.973	1.28	0.676	227.5[d]	0.025	0.2268
disgust A	2.90	1.511	1.90	1.235	1630.0[e]	<.001	0.7804
pity A	1.66	1.055	1.63	0.987	220.5[f]	0.693	0.0309
sadness A	2.71	1.479	1.88	1.233	1408.0[g]	<.001	0.5387
surprise A	3.26	1.510	2.11	1.204	1676.0[h]	<.001	0.7365
joy B	1.85	1.036	2.51	1.346	175.0[i]	<.001	-0.764
anger B	1.94	1.230	1.47	0.845	681.0[j]	<.001	0.660
fear B	3.07	1.431	2.24	1.074	1796.0[k]	<.001	0.900
disgust B	1.59	1.082	1.42	0.890	284.0[l]	0.147	0.303
pity B	1.84	1.146	1.46	0.882	445.0[m]	<.001	0.684
sadness B	1.96	1.289	1.54	0.917	616.0[n]	<.001	0.663
surprise B	2.86	1.441	1.96	1.160	1370.0[p]	<.001	0.915

a 41 pair(s) of values were tied, b 23 pair(s) of values were tied, d 72 pair(s) of values were tied, e 38 pair(s) of values were tied, f 68 pair(s) of values were tied, g 39 pair(s) of values were tied, h 36 pair(s) of values were tied, i 42 pair(s) of values were tied, j 56 pair(s) of values were tied, k 35 pair(s) of values were tied, l 67 pair(s) of values were tied, m 64 pair(s) of values were tied, n 58 pair(s) of values were tied, p 43 pair(s) of values were tied.
A = anger eliciting vignettes, B = anxiety eliciting vignettes

Cognitive and Reappraisal strategies

Based on the inductive content analysis, we identified 17 cognitive and reappraisal strategies used by the subjects in our sample to change their emotional responses to the situations presented in the vignettes. The participants used the reappraisal strategies to different degrees, (lowest value 0, highest value 16, *media* $n = 4$, $m = 4.32$, $SD = 2.51$). The subjects who used zero reappraisal strategies (in 3.4% cases) applied avoidance, distraction or emotional detachment instead as self-

regulation techniques. The frequencies for the entire sample can be seen in Figure 1. The cognitive and reappraisal strategies identified could be divided into at least two categories, (a) 11 effective emotion and reality focused reappraisal strategies, and (b) 6 additional cognitive processes that were used alongside self-regulation processes, such as awareness, beliefs, and avoidance/emotional detachment as alternatives to reappraisal. A complete description of the categories identified and their relation to the categories described in the introduction to our study can be found in appendix A of this paper.

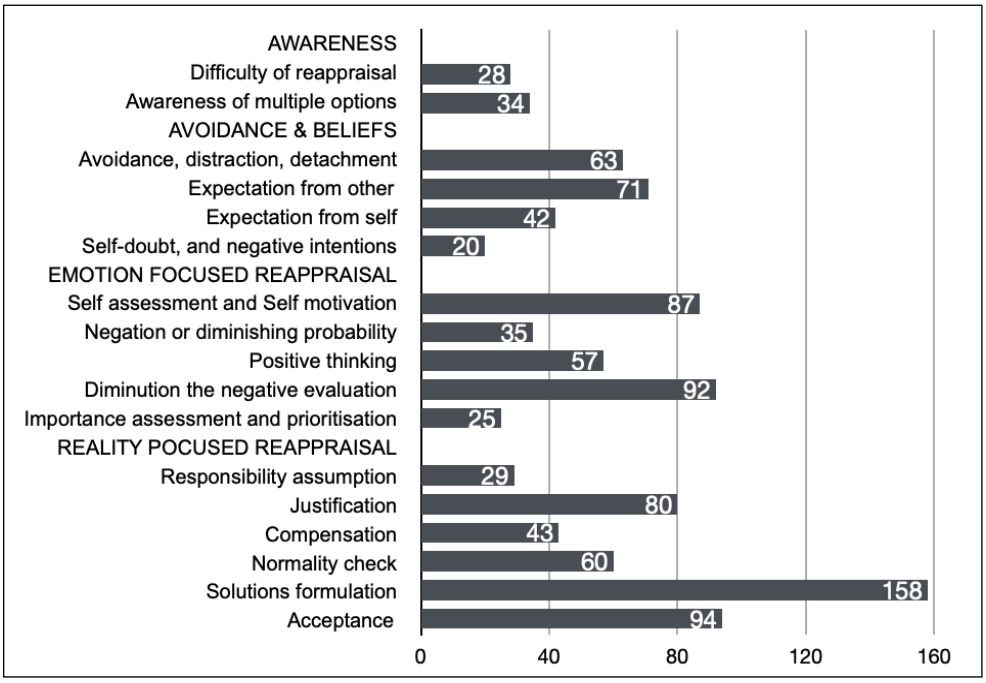

Figure 1. Frequency of reappraisal strategies and additional cognitive content

Note. As a point of reference for assessing the frequency of each reappraisal strategy, there are 192 total situations (value that is calculated multiplying the 8 emotions eliciting situation with N = 24 subjects)

Discussion

In our attempt to find possible underlying mechanisms in order to understand the variation in the efficacy of reappraisal strategies for the regulation of unwanted emotions (Deplancke et al., 2022; Ford et al., 2017; Ford & Troy 2019; Newman &

Nezlek, 2021), we identified (a) awareness as a possible mediator, (b) eleven reappraisal strategies, and (c) two cognitive processes which could have a role in the efficacy of reappraisal as an emotional self-regulation strategy (Brockman et al., 2023, Cohen Ben Simon et al., 2022, Wang & Yin, 2023).

Changes in emotional response to stress eliciting situations

Based on our results, the reappraisal strategies were effective in changing the emotional response of the participants. This can be seen as a first level of validation of our forward analysis of the identified reappraisal strategies. The results for pity and for anger eliciting situations and for disgust in anxiety eliciting situations were to some degree expected, based on Kollias et al.'s (2019) emotion wheel, using arousal, valence, level of control, and obstructiveness as criteria to assess emotions that have a high probability of being present together at the same time. Secondly, based on the fact that the initial values for pity and anger were in each case almost at the baseline, almost no change could occur. Thirdly, this could suggest that participants used reappraisal strategies primarily focused on the main emotions elicited by the vignettes they were given.

Approach as a non-discrete measure of emotion can be best seen as an assessment of a behavioral tendency or as the consequence of an emotional response. Avoidance can be seen as an expected behavioural response to anxiety. It is possible that approaching an anger eliciting situation is an expected behavioural response to anger as an emotion. The lower effect size of the pre- vs post- intervention for anger and anxiety on the approach scale, could be explained by the above expected behavioural tendencies.

Awareness and reappraisal strategies

In the process of identifying multiple reappraisal strategies which serve to regulate emotions we identified three levels of awareness: (a) subjects who were unable to find a different point of view for the situation and verbalized their difficulty in reappraising the imagined situations; (b) subjects who were easily able to find reappraisal strategies but were limited to one version of the imagined situation; and (c) subjects who could imagine variations from the situation and found different reappraisal strategies, depending on the context, or, in other words, subjects who were aware of multiple possibilities.

These results suggest that a higher level of awareness could make an important contribution to the effectiveness of finding and applying reappraisal strategies. Some recent studies trying to test and elaborate a model for the mindfulness-to-meaning theory have used multivariate path analysis (Cheung & Ng, 2020; Hanley et al., 2021; Garland, Hanley, Goldin & Gross, 2017), and show a similar relationship between awareness and reappraisal. More specifically, Hanley

et al. (2021) present a model based on longitudinal data in which mindfulness interventions contribute to decentering which could contribute to broadening awareness, which in turn can lead to increased positive reappraisal, which again in turn can contribute to a higher level of well-being. These studies refer to a residual effect of mindfulness-based stress training that manifests itself over time. In our study the effect of awareness appears to occur simultaneously with the process of reappraisal, which raises questions about the possibility of a more direct and simultaneous effect. This question is in accord with the findings of Füstös et al. (2013) that interoceptive awareness facilitates the down-regulation of emotions, which were measured at the physiological level (Brockman et al., 2023, Cohen Ben Simon et al., 2022, Wang & Yin, 2023).

Two principal additional reappraisal strategy groups

The reappraisal strategies identified include additional strategies described by McRae et al. (2012). Acceptance is a reappraisal strategy that normalizes the negative event and can include a wide perspective concerning negative things that happen (McRae et al., 2012). We identified four reappraisal strategies that could be included in this category and we think it could be beneficial when undertaking future interventions and training to include (a) justification, (b) responsibly assumption, (c) normality check, and (d) acceptance, as we have defined them in the appendix A, each to be treated and studied separately. Each of these four reappraisal strategies has a very clear goal, is quite specific, and is clear to follow in practice, and their efficacy will need to be tested by future studies. Compensation for negative events stood-out in the content analysis as an additional reappraisal strategy, being focused on finding something useful, although not necessarily something positive, about anger or anxiety eliciting situations.

The reappraisal strategies with the highest frequency were solution search and solution formulation. Subjects generated multiple solutions for some of the anger and anxiety eliciting situations, for example, a situation in which they had to imagine that in the middle of night, they were woken by a loud noise coming from their living-room and saw an open window in their living-room. Based on our exploratory approach, the question arises whether the type and number of reappraisal strategies could be influenced by the characteristics of a specific given situation.

Beliefs and Reappraisal strategies

The focus of the participants in our study on the verbalization of their expectations regarding themselves and others appears to have made them defocus on finding reappraisal strategies. This observation suggests that the activation of some beliefs about expected behaviour or results in a specific stressful situation could interfere with the process of finding and applying effectively reappraisal strategies

as emotional self-regulation. Previous studies highlight the important relationship between beliefs and self-regulation efficacy, and this has also been identified in other studies (Akyunus et al., 2021; Buffie & Nangle, 2022; Deplancke et al., 2022; Ford et al., 2018), which studied beliefs about emotional controllability and their impact on using reappraisal strategies to self-regulate. Ford et al. (2018) found, using a diary-based study, that entity beliefs were associated with reappraisal strategies which were little used in everyday life. These studies suggest that our finding that a main focus on beliefs and expectations regarding how a situation could or should be, may serve to interfere with the process of finding and applying effective reappraisal strategies.

Limitations and Future Directions

The limitations of our study are due to the characteristics of our exploratory mixed design. First the instructions to the subjects to verbalize identify reappraisal strategies could have influenced their thought process and could have captured only the declarative elements. Secondly, the relative short time between the pre- and post-assessment of emotional response with regard to the presented stress eliciting situations means that the participants responses could have been influenced by response expectancy. Thirdly, the specific situations could have influenced what kind of reappraisal strategies would be more likely to be activated or used. These three limitations lead us to be cautious about our conclusions, without undertaking future research to test them. Our fourth limitation could support the findings we obtained, namely, that some of the subjects stated in the post-experiment debriefing that in some cases during the reading of the emotion eliciting vignettes for the first time, before having been given the task of reappraising the situation, and before assessing their initial emotional response, they had already considered alternative interpretations of the event.

Conclusion

Our exploratory study had as its primary goal the identification of possible underlying mechanisms with regard to reappraisal strategies. The questions that our study aimed to answer were, (a) are specific reappraisal strategies well enough defined in the scientific literature to allow them to be used in training programs, and (b) what cognitive process are activated during the reappraisal process that can influence emotional outcomes. Our results are important because they could help, through future studies, to provide a better understanding of the variations in efficacy of reappraisal strategies through: (a) the identification of eleven clearly defined reappraisal strategies which offer specific and focused reappraisal strategies that can be taught as cognitive intervention techniques; (b) the four reappraisal strategies that could be included in acceptance, which could significantly contribute to a better

understanding of the variation in efficacy of reappraisal strategies; and (c) the question of whether some reappraisal strategies could be facilitators of the reappraisal process (see the description of positive self-assessment, self-motivation and importance assessment, and prioritization from Appendix A.)

Our work represents a contribution to the existing literature in two ways. Firstly, it identifies the specific cognitive techniques that emerged from the clear definition of the four identified acceptance focused reappraisal strategies. And secondly, it shows that awareness and activation of specific beliefs can influence the self-regulation process.

We believe that our results suggest two main directions for future research. One direction would be to study the possible mediation role of awareness and expectation in the efficacy of reappraisal strategies. A second direction would be orientated towards testing the efficacy of training and intervention based on the eleven identified reappraisal strategies.

We consider that our study points out some of the important factors involved in the variation in efficacy of reappraisal as an emotional self-regulation strategy, as presented in the existing scientific literature.

Authors' Note

Conflict of Interest. The authors hereby declare that there are no potential conflicts of interest associated with this publication, and that no financial support has been received.

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Appendix A

1. Emotional focused reappraisal

1.1. **Positive self-assessment, self-motivation** - an emotion orientated reappraisal strategy that is focused on self-validation, which could bring benefits in the shape of (a) motivation, and (b) act as support to enhance the process of self-regulation through other reappraisal strategies.
1.2. **Negation or diminishing probability** - a reappraisal strategy that questions the reality of an experienced event or minimizes the likelihood of risks or consequences that could happen. Affirmations like: *"It can't happen to me"*, best describe this strategy.
1.3. **Positive thinking** - a positive interpretation of an expected outcome, often without a relying on facts or on realistic information. Affirmations like: *"Everything will be all-right*", describe this strategy best.
1.4. **Diminution of negative evaluation** - reappraisals that include humour, empathy, and other changes in point of view regarding a specific stressful event that contributes to a change in the perceived negativity of the short and long term consequences of the experienced event.

2. Reality Focused Reappraisal

2.1. **Importance assessment and prioritization** - a reappraisal strategy that subjects use as a way of reminding themselves to find solutions to specific problems. It can be seen as a part of Technical–Analytic–Problem Solving reappraisal tactic, McRae et al., (2012). It can be seen as a strategy that self-regulates the reappraisal process.
2.2. **Responsibility assumption** - a strategy in which the participants recognise their own contribution to the unwanted outcome of a stressful situation.
2.3. **Justification** - a strategy in which the subjects search for acceptable excuses that could help them to minimize the unwanted behavior of others.
2.4. **Compensation** - reappraisal strategies where the subjects identify a potential chance to improve or engage in self-development through the experienced situation. This strategy differs from positive thinking by focusing on potential future actions or opportunities, and bears more resemblance to McRae et al's., (2012) changing current or future circumstance. Affirmations like: *"No problem that my friend didn't water my plants, at least I know who I can trust"*, best describes this strategy.
2.5. **Normality check** - subjects try to compare the experienced situation to a social or outside norm, in order to establish the normality or the degree to which some specific behavior could be accepted as normal or realistic. This type of strategy is sometimes included in the acceptance category by researchers.
2.6. **Acceptance** - a reappraisal strategy focused on taking the experience as it is in situations that are perceived as being outside of one's own control. This reappraisal strategy is not usually associated with any additional conclusions, such as

justification, compensation or similar strategies. Affirmations like: *"This is the situation and I can live with it"*, best describe this strategy.

2.7. **Solution formulations** - reappraisal strategies focused on practical actions and behavior that can be made in order to change the consequences of emotion eliciting events. This category is similar to Technical–Analytic–Problem Solving reappraisal tactic, McRae et al., (2012).