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REVIEW

Distract or Reappraise? The Mechanism of Cognitive Emotion Regulation Choice and Its Influential Factors

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Abstract: Previous research on emotion regulation has focused more on the regulation effects corresponding to a particular emotion regulation strategy, yet the same regulation strategy may produce different regulation effects in different contexts. Similarly, one regulation strategy may not be applicable to all situations. Emotion regulation choice refers to the process by which individuals choose different regulation strategies in different contexts. Executive control and the level of engagement-disengagement considerations are the cognitive mechanisms of emotion regulation choice, while the neural mechanisms of emotion regulation choice still need to be explored more directly and deeply. Studies have found that affective, cognitive, and motivational factors have different degrees of influence on emotion regulation choice. However, there is still a lack of a reliable framework to systematically investigate the relationship between these influences and the outcome of their combined effect on emotion regulation choices. Future research needs to further explore the neurophysiological basis of emotion regulation choice by using different techniques and constructing a complete model based on multiple factors to more accurately grasp the dynamic process of emotion regulation choice.

Keywords: emotion regulation choice, cognitive reappraisal, distraction, emotion regulation flexibility, cognitive flexibility

Introduction

Emotions affect people's lives all the time. Different emotion regulation strategies provide us with multiple means to cope with the effects of emotions.[1] Previous research on emotion regulation has focused more on the regulation effects corresponding to specific emotion regulation strategies, such as distraction being effective in reducing individuals' negative emotions in a short period,[2] while cognitive reappraisal is often associated with more positive interpersonal relationships,[3] higher levels of mental health.[4–6] However, studies have also suggested the opposite; for example, some studies have found that distraction is associated with lower well-being, more psychopathic symptoms, and lower social satisfaction.[7–9] Moreover, distractions do not produce adaptive outcomes in situations requiring long-term emotional regulation.[10] In addition, some researchers have found that the use of distraction has more adaptive effects than the use of cognitive reappraisal when dealing with stressful or traumatic events. This is because reappraisal consumes significant resources of self-control[2] and leads to greater activation of the sympathetic nervous system.[11] Thus, there is no absolute adaptive or non-adaptive emotion regulation strategy per se,[12,13] and the ability of individuals to make flexible emotion regulation choices in different situations plays a very important role in the effectiveness of emotion regulation.[13–15] In recent years, researchers have gradually shifted from focusing on the tendency and effectiveness of emotion regulation to paying more attention to the flexibility and adaptability of emotion regulation.[16]

Choice behavior is a fundamental means by which individuals control their environment.[17] Emotion regulation choice refers to the act of autonomously choosing between different regulation strategies available in a given context.[18] According to the extended process model of emotion regulation, emotion regulation choice is in the second stage of

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the overall emotion regulation process.[19] It is important to emphasize that the choice stage included not only deciding which strategy to use, but also whether to regulate,[20] that is, the goal or intention of performing a particular behavior or obtaining a particular outcome.[21] Thus, the term "emotion regulation choice" represented how a person decided to work towards that goal or achieve the desired outcome.[22] However, there is still a lack of systematic research regarding the determinants and underlying mechanisms of emotion regulation choice. Therefore, this review will focus on empirical research over the past decade on the topic of "emotion regulation choice". Studies that measure the frequency with which individuals use a particular regulation strategy and studies that ask individuals to use a particular strategy to regulate their emotions in a given situation are not included because they do not reflect whether and how individuals choose to regulate their emotions. We will first clarify the theoretical basis and basic pattern of emotion regulation choice based on the conceptual framework proposed by Sheppes et al.[23] Then, we will elaborate on the factors influencing emotion regulation choice from four aspects: affective, cognition, motivation, and individual differences, and further analyze the intrinsic mechanisms of emotion regulation choice by combining evidence from previous empirical studies; finally, we will propose future research ideas to lay the foundation for a deeper understanding of the role of emotion regulation choice in psychological disorder intervention.

Basic Pattern of Emotion Regulation Choice

Drawing on information processing theory[24] and the process model of emotion regulation,[1] Sheppes et al propose a conceptual framework of emotion regulation choice that argues that emotion regulation involves intentional executive control mechanisms and attempts to change the nature of emotional information processing during two main cognitive stages: early attentional selection and later semantic meaning stages. One of the typical early selection strategies is distraction, ie, shifting attention away from the current emotional information before an emotional response is generated;[25] the classical late selection regulation strategy is reappraisal, ie, emotional information enters among working memory and requires some response to the emotional information, by reconstructing the meaning of the current situation in order to change its emotional impact.[25,26] Cognitively, the process of distraction generation involves generating neutral thoughts that are independent of and do not conflict with the original emotional information, which is simpler than generating reappraisals,[2] thus, according to the conceptual framework, distraction blocks effective information emotionally and allows for more successful modulation of high-intensity information, whereas reappraisal allows emotional information to gather force prior to a late modulation.[2] Empirical studies have further demonstrated that subjects prefer distraction in high-intensity negative situations, but choose cognitive reappraisal more often in low-intensity negative situations.[23,27,28] This pattern of results has also been demonstrated in response to positive images[29,30] and negative sounds[31] as well as shocks.[32]

However, it is worth noting that in the emotion regulation choice paradigm, subjects are presented with negative pictures of varying intensity beforehand and then asked to choose between two strategies based on how they feel, whereas real-life events often occur unprepared and do not always restrict us to choosing between two strategies as in laboratory conditions, or give us time to prepare and decide to use a particular strategy, but often we are required to make a choice immediately. Thus, this basic pattern may not be applicable to situations in which the emotional stimulus is unknown to the subject in advance. In studies using experience sampling with high ecological validity, researchers have found that people use a similar pattern of emotion regulation choices throughout adulthood, ie they show a strong preference for early intervention strategies for emotional processes, such as distraction, and strategies that engage/increase positive aspects, a pattern that is particularly evident in older adults,[33–36] in the same setting, where flexible choices between strategies are more adaptive.[37]

Influential factors on Emotion Regulation Choices

Affective Factors

Previous studies have confirmed that emotion intensity was a robust influencer of emotion regulation choices.[31,38–42] High emotional intensity increases an individual's cognitive load, which competes with the cognitive resources required for emotion regulation. Cognitive reappraisal required more cognitive resources and was more difficult to implement, in

which case people prefer distraction strategies that required less cognitive resources and was effective in reducing individuals' negative emotional experiences in the short term. Recently, researchers found that in high-intensity emotional situations, the attentional breadth of subjects was low, attentional breadth partially mediated the effect of motivational intensity on emotion regulation choice.These findings suggest that an increase in emotional intensity during emotion regulation prompts individuals to choose distraction over reappraisal by narrowing attentional breadth.[43]

Regarding how valence affects emotion regulation choices, some studies have found differences in the regulation strategies people choose in response to positive and negative stimuli. For example, Hay et al found that subjects who regulated negative emotions were more likely to choose distraction than subjects who regulated positive emotions.[27] Moreover, people usually prefer to approach positive stimuli and/or avoid negative stimuli.[44,45] In addition, different discrete emotions affect people's emotion regulation choices.[42] Vishkin et al found that people use different tactics of cognitive reappraisal to regulate different emotions, specifically, people prefer to use an acceptance reappraisal strategy to regulate sadness; trying to think about alternative future consequences to regulate fearfulness.[46] When the emotion being regulated is anger, people typically choose cognitive reappraisal more frequently; and for disgusting emotions, people choose distraction strategies more often.[42]

Cognitive Factors

Among the cognitive factors that influence emotion regulation choices, we focused on reappraisal affordance and cognitive effort. Reappraisal affordance refers to the opportunities for semantic re-interpretation inherent in a stimulus.[47] Emotional stimuli can have varying levels of reappraisal affordances, even in contexts with equivalent levels of intensity. For example, a picture of an argument may be interpreted in multiple ways, while a picture of a car accident is much less likely to be reinterpreted. This meant that the former has a higher reappraisal affordance than the latter. In a recent study, researchers found that reappraisal affordance was an important external factor influencing emotion regulation choice,[47] and both self-reported reappraisal affordances[42] and experimentally manipulated reappraisal affordance[23,48] are associated with a greater choice of reappraisal. Higher reappraisal affordance predicted a greater tendency to choice cognitive reappraisal, whereas low reappraisal affordance tended to choice distraction.[31,42,47] Deviations from availability-oriented emotion regulation choices may be associated with some poor emotional performance.[49] For example, the inability to distract from low reappraisal affordance stimuli may lead to rumination, which in turn leads to depression.[50] And the inability to cognitively reappraise negative emotions with high reappraisal affordance may be associated with anxiety disorders.[49,51]

Emotion regulation choice is also influenced by an individual's perception of the effort required to attempt regulation. Milyavsky et al showed that subjects were more likely to choose cognitive reappraisal when the cognitive effort was reduced.[41] Furthermore, there was an interaction between cognitive effort and emotion intensity on emotion regulation choice; specifically, subjects were more likely to choose cognitive reappraisal in response to high-intensity emotion pictures at low cognitive effort than at high cognitive effort.

Motivational Factors

Emotion regulation is an instantiation of motivated regulation in the emotion domain.[52] First, researchers have explored the effects of goal motivation on emotion regulation choices from different perspectives of goals, such as temporal goals (long-term or short-term regulation goals),[23] directional goals (up- or down-regulation of emotion goals),[53] situational/instrumental goals.[54] Specifically, it was found that individuals were more inclined to choose reappraisal with long-term goals than with short-term goals,[23] a result that was expanded upon in a recent study by Ortner et al, which found individual differences in the tendency to consider future consequences of one's actions (CFC) would moderate the effect of goal on emotion regulation choice. Participants low in CFC chose reappraisal more often if given a short-term goal than a long-term goal, but participants high in CFC chose reappraisal more often if given a long-term goal than a short-term goal.[55] People choose distraction more often when trying to down-regulate emotions and tend to choose rumination when trying to up-regulate emotions.[53] It has also been found that people prefer emotions that help them achieve a specific goal, even if that emotion comes at the cost of experiencing a negative emotion.[54,56–58]

Furthermore, the anticipation of the situation or task can also influence how individuals choose to regulate their emotions. Specifically, both the high cognitive demands of the task and the potential threat influence participants' affective preferences.[59,60] Milyavsky et al used cognitive energy theory to explain the relationship between motivation and emotion regulation choices.[41] The theory suggests that the likelihood of launching any cognitive process is a function of two opposing forces: the driving force (ie, the motivation to launch the process) and the restraining force (ie, task difficulty). The researchers concluded that people chose cognitive reappraisal less frequently because they anticipated difficulty in implementation and that the frequency of choosing cognitive reappraisal increased when individuals' anticipations of task difficulty were reduced. In conclusion, motivational factors are one of the important factors influencing the choice of emotion regulation.

Individual Differences

Previous research has found that individual differences such as gender, age, and personality traits are all influential factors in emotion regulation choices. For example, males are more likely to use expressive inhibition compared to females; the frequency of cognitive reappraisal use increased with age, while the use of expressive inhibition decreased;[61] individuals with high avoidance traits used distraction more,[62] and individuals with extroverted personality traits were more likely to use cognitive reappraisal;[4] individuals with low emotion regulation self-efficacy experience more helplessness during emotion regulation[63] and less flexibility in emotion regulation;[64] and individuals with high self-efficacy of emotion regulation used cognitive reappraisal strategies more often.[65]

In addition, some studies on specific groups with psychological disorders have found differences in their emotion regulation choices compared to normal groups. Specifically, both individuals with bipolar disorder,[27] borderline personality disorder,[66] internet addiction,[67] and posttraumatic stress disorder[68] chose cognitive reappraisal less frequently compared to the normal group, and exhibiting inflexibility in emotion regulation choices. This may also contribute to their emotional dysregulation.

Mechanisms of Emotion Regulation Choices

Cognitive Mechanisms of Emotion Regulation Choice: Executive Control and Situational Involvement

Information processing theory[24] and the process model of emotion regulation[1] suggested that emotion regulation, as a goal-driven behavior, required the involvement of cognitive control mechanisms. Individuals have limited cognitive resources and thus imposed limitations on ongoing emotion generation processes, and these limitations lead to constant competition between emotion generation and emotion regulation process to dominate the output of the cognitive system.[69] The cognitive control theory of emotions[70] integrates the functions of both top-down and bottom-up systems, emphasizing that both types of systems can work together to regulate emotions and thus help individuals adjust dynamically to changes in the context.[71] More recently, the cognitive control framework model of emotion regulation flexibility[72] further proposes to integrate executive functions with emotion regulation flexibility, emphasizing the important role of executive functions in strategy change and adaptation to changing situational demands and goals. Both of these theories provide a theoretical foundation for a deeper understanding of how executive function influences different aspects of emotion regulation.

Empirical research further supports the above theoretical perspectives; for example, Sheppes et al explored individuals' choices to shift attention or reappraise when controlling positive emotions of different intensities and found similar patterns of choice as in negative contexts, ie, in high-intensity positive contexts, people chose the strategy of shifting attention more often, whereas, in low-intensity positive contexts, people more likely to choose cognitive reappraisal in low-intensity positive situations.[23] This result supports the interpretation of intentional executive control on emotion regulation choices, ie, although individuals regulate positive emotions of different intensities, they control their emotional experiences within reasonable limits by choosing regulation strategies for different emotional intensities through the function of intentional executive control. In a study examining individual cognitive flexibility using heart rate variability, subjects with lower cognitive flexibility responded more strongly to continuously changing emotional scenarios and were

less likely to disengage.[73] Cognitive flexibility, an important component of executive functioning, suggests that cognitive flexibility plays a facilitative role in emotion regulation flexibility and can help individuals to flexibility in responding to changing situations.

Engagement-disengagement considerations emphasized that people choose emotion regulation strategies more for strategy effectiveness than for cognitive effort, ie, they prefer effective strategies, even if they are more difficult to implement.[23] The distraction strategy is to disengage from the current processing of emotional information before it enters the working memory system to avoid producing strong emotions,[25,74] and thus the contextual involvement of this strategy is low, whereas the cognitive reappraisal is high when the emotional information has already entered the working memory and produced strong emotions, and it is necessary to reconstruct the meaning based on the original emotional information to change its emotional impact.[25,26,75] It follows that distraction strategies with low contextual involvement in high-intensity stimulus situations can regulate emotions more effectively.[2,11] Thus, the level of contextual involvement of a strategy during emotion generation is one of the mechanisms inherent in the choice of emotion regulation strategies. It is worth noting that cognitive reappraisal is a complex multi-process system that includes multiple seed strategies. One study divided cognitive reappraisal into two sub-strategies, re-understanding, and distance perception, and found that in low emotional stimulus intensity situations, subjects chose re-understanding and distance perception strategies more often than a distraction to reduce negative emotional experiences; in high emotional stimulus intensity situations, subjects chose distraction and re-understanding/distance perception strategies. There was no significant difference in the rate of subjects choosing the distraction and reconceptualization/distance strategies in high emotional stimulus intensity situations. However, it has also been found that in high-intensity negative stimuli, subjects more often chose the distance strategy than the reperception strategy.[41] This suggests that there may be differences in contextual involvement between cognitive reappraisal sub-strategies, and future research needs to further clarify the differences in contextual involvement between sub-strategies and the effects on the choice of emotion regulation strategies.

Neural Mechanisms of Emotion Regulation Choice

The cognitive control model of emotion[70] suggests that emotions are generated and regulated by the interaction of the prefrontal-cingulate system (which governs executive function processes) and the subcortical system (which governs various types of emotional appraisal processes), including a bottom-up emotion appraisal system and a top-down cognitive control system. Individuals are influenced by a combination of internal executive function processes and the external environment during emotion regulation.

Previous neuroimaging studies have confirmed that the amygdala, prefrontal cortex, and right dlPFC are brain regions closely associated with emotion regulation, for example, one study found that cognitive flexibility was negatively correlated with the level of right inferior frontal gyrus activation during cognitive reappraisal, suggesting that individuals with high cognitive flexibility are more likely to engage in cognitive reappraisal;[76] decreased cognitive flexibility can lead to individual susceptibility to negative emotions and is associated with abnormal activation in the prefrontal and anterior cingulate cortex;[77,78] another neuroimaging study found that subjects with significantly increased activity in the amygdala (associated with emotion production) as well as the prefrontal cortex (associated with cognitive control) when viewing negative pictures were more inclined to emotion regulation in subsequent tasks.[79] In high-intensity negative situations, activation of the right dlPFC is enhanced by reappraisal, which requires more cognitive resources.[80] However, this study did not directly address the strategy selection task and thus can only serve as indirect evidence for exploring regulatory choice. More direct evidence was provided by an ERP study exploring the effects of different negative emotion intensities on emotion regulation strategy choice, which used ERPs to continuously record subjects' EEG signals (LPPs) while viewing pictures of different negative emotion intensities and asked subjects to choose between different regulation strategies (shifting attention vs cognitive reappraisal), and EEG analysis revealed that enhanced LPP amplitude predicted enhanced shifting attention preference.[30]

Although EEG and neuroimaging studies have identified a number of neural correlates of emotion regulation choice, no studies have directly manipulated brain regions associated with emotion regulation choice to explore the relationship between choice and related brain regions. Some researchers have found that this may help to enhance the cognitive flexibility of individuals by performing transcranial direct current stimulation of the dorsolateral prefrontal cortex, thus

accelerating the disengagement from negative stimuli.[81,82] Future researchers could try to use transcranial direct current stimulation to act on the relevant brain region that affects emotion regulation, alter the excitation level in the cortex of that region, and then investigate the role of that brain region in choosing distraction or reappraisal, thus revealing more directly the neural mechanisms underlying emotion regulation choices.

Summary and Future Directions

Flexibility in choosing between different emotion regulation strategies depending on the context is an important factor in maintaining physical and mental health and well-being.[14] We focus on the basic pattern, cognitive and neural mechanisms, and influential factors of emotion regulation strategy choice, and clarify that people's choice of distraction or cognitive reappraisal regulation strategies is influenced by multiple factors such as affective, cognitive, motivational, and individual differences. Accordingly, we propose a framework for more intuitive understanding the mechanism of cognitive emotion regulation choice and its influential factors(see Figure 1). Future research may consider the following:

First, most experimental studies on emotion regulation choice use the emotion regulation strategy choice paradigm, which exchanges the initiative of strategy choice to subjects rather than specifying a particular strategy to regulate emotions, thus revealing the process by which individuals choose emotion regulation strategies in different contexts. It is worth noting that this paradigm usually presents emotional stimuli to subjects in advance, ie, subjects make choices with preparation, however, in real life individuals are often faced with unprepared, immediate choices and often face situations that are more complex than laboratory settings. Therefore, future research needs to consider improving the ecological validity of the research paradigm to reveal the true process of how individuals make emotion regulation choices in complex situations; in addition, individuals may have more than one strategy activated during the emotion regulation strategy selection phase,[83] and some strategies may be implicit. It has been shown that people use multiple strategies to manage negative emotions and shift from directive to non-directive regulation strategies when emotional intensity is high.[84] Therefore, future research needs to consider neuroimaging techniques combined with self-report methods to provide clearer and more accurate monitoring of subjects' selection processes, to better disentangle the selection of directive and spontaneous emotion regulation strategies, and to explore the differences and associations between the two in terms of their effects on final emotion regulation effects.

Second, it has been suggested that emotion regulation flexibility is a subset of cognitive flexibility[85] and that it may be a specific manifestation of cognitive flexibility in changing regulation strategies according to the context, facilitating individuals to respond differently to changing situations.[16] However, whether cognitive flexibility has an indirect or

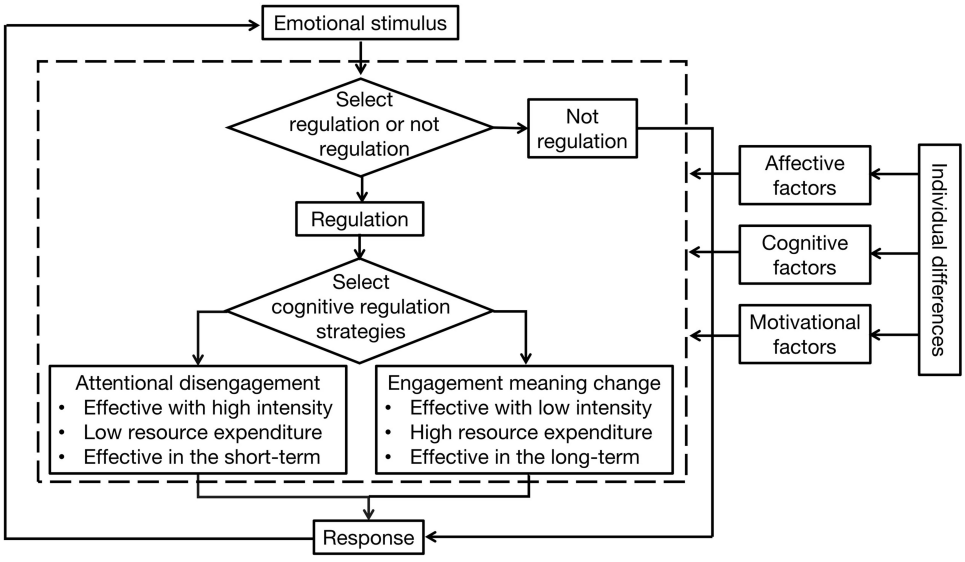

Figure 1 Framework for understanding the mechanism of cognitive emotion regulation choice and its influential factors.

direct effect on individuals' emotional responses requires further empirical investigation. It is important to note that greater flexibility in emotion regulation choices is not better, and too much flexibility may reflect hypersensitivity or instability to situations.[86] Some researchers have suggested that excessive cognitive flexibility in female populations may be associated with excessive attention to or analysis of emotions, leading instead to reduced emotion regulation adaptability.[87] Some researchers have suggested that excessive cognitive flexibility in female populations may be associated with excessive attention to or analysis of emotions, leading instead to reduced emotion regulation adaptability.[87]

Third, several studies using patients with affective disorders as subjects found that patients with affective disorders exhibited inflexible emotion regulation choices compared to normal individuals, suggesting that flexibility in emotion regulation choices is one of the key characteristics of physical and mental health. Future studies may try to provide new ways to treat depression, anxiety disorders, and addiction from the perspective of influencing the flexibility of individual emotion regulation choices. Some researchers have proposed an intervention sequence of directed attention and action readiness to increase flexibility in choosing effective emotion regulation strategies, eg, increasing an individual's directed attention in the early stages of the intervention (eg, setting a ringtone alert on a cell phone) and focusing on action readiness in the later stages of the intervention, eg, increasing an individual's intention to perform, as a way to increase the frequency with which people use effective regulation in situations that require emotion regulation strategies more frequently.[88] Neuroimaging studies have demonstrated that dorsolateral and ventral medial prefrontal function is an important factor influencing depression and anxiety,[89,90] and future research could try to use pathway electrical stimulation acting on brain regions where cognitive flexibility interacts with emotion regulation to directly influence the effect of emotion regulation in individuals.

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Disclosure

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