RESEARCH

The role of emotion recognition in reappraisal affordances

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Abstract

Introduction Emotion regulation is essential for psychological well-being. One strategy that is commonly researched is reappraisal. Individual differences regarding the tendency to use reappraisal, as well as its implications for affective experience, were extensively studied. In recent years, interest has emerged in the choice to use reappraisal, based on stimuli properties. Recently, we suggested that reappraisal is related to emotion recognition processes. Emotion recognition (and affective labeling, as an explicit form of emotion recognition) is regarded as a form of emotion regulation, however, the relations between emotion recognition and reappraisal have not been previously investigated. The aim of the current study was to explore the relationship between reappraisal affordances (the opportunities of re-interpretation that are inherent in a stimulus) and emotion recognition.

Method For this purpose, we used the Categorized Affective Picture Database, a database that provides data regarding the emotional category of each picture, agreement levels for each category, and intensity ratings. Agreement levels were used to assess the certainty regarding the emotion evoked by the pictures.

Results Findings suggest that reappraisal affordance is predicted by both agreement levels and intensity, in negative pictures alone. In negative pictures, intensity was negatively correlated with the difficulty to reappraise.

Discussion These findings strengthen the hypothesis regarding the relationship between emotion recognition and reappraisal, and provide evidence for the role of emotion recognition in reappraisal affordances.

Introduction

The ability to regulate emotions adaptively is important for well-being and mental health. As such, emotion regulation is at the focus of research of emotional disorders (Aldao et al., 2010). One of the most studied strategies to regulate emotions adaptively is reappraisal, which entails a cognitive change in the way one perceives an emotional situation, in order to change or decrease the intensity of the emotional state (Gross, 2002). Different studies have found that using

reappraisal to regulate negative feelings decreases subjective experience of these feelings (Goldin et al., 2008; John & Gross, 2004; Ochsner et al., 2004). In fMRI studies, reappraisal use was found to be related to increased activity in pre-frontal cortex (PFC) areas (dorsomedial, dorsolateral and ventrolateral) and the posterior parietal lobe, and to decreased activity in the amygdala (Buhle et al., 2014). Taken together, these findings suggest that regulation of negative emotions through the use of reappraisal is highly efficient.

Another emotion regulation strategy receiving increased attention in recent research is affect labeling (which will be hereinafter referred to as labeling; Kircanski et al., 2012; Lieberman et al., 2007; Niles et al., 2015). Labeling is defined as "putting feelings into words" (Lieberman et al., 2007), and includes labeling one's own emotions or labeling the emotions of another person. In daily life we usually label emotions by speaking ("I'm sad") or writing them. However, various studies used a paradigm of emotional categorization

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(Burklund et al., 2014; Lieberman et al., 2007). It was found that when participants label their emotional experience (either positive or negative), emotional experience decreases (Lieberman et al., 2011). Similar to reappraisal, labeling results in increased activity in pre-frontal areas (ventrolateral PFC, dorsolateral PFC, posterior dorsomedial PFC) and decreased activity in the amygdala (Burklund et al., 2014). However, research regarding the subjective experience is inconsistent. While in some studies labeling resulted in reduction of negative experience (Burklund et al., 2014; Lieberman et al., 2011), other studies did not find an effect of labeling on subjective experience (Kircanski et al., 2012). Some time ago, we suggested that labeling and reappraisal are strongly related (Moyal et al., 2014). Specifically, we proposed that in order to use reappraisal effectively, one has to identify (explicitly or implicitly) the emotion that the situation evokes. In accordance with this hypothesis, we suggested an elaboration of the process model of emotion regulation (Gross, 1998) to include emotion recognition as a distinct stage of emotion regulation (Moyal et al., 2014). In the renewed model, emotion recognition occurs before cognitive change, and we suggested that effective cognitive change is based on successful emotion recognition. Labeling is the explicit form of emotion recognition, but reappraisal can also occur with implicit emotion recognition. A similar suggestion can be found in the extended process model of emotion regulation (Gross, 2015). According to this model, a valuation step, which includes emotion identification, precedes the decision whether an emotion should be regulated and how. Gross (2015) suggested that this is a crucial step, and without an identification of the emotion, emotion regulation might fail. These suggestions are supported both by evidence-based treatments like cognitive behavioural therapy (CBT) and by research on emotional understanding, psychopathology and reappraisal. When using CBT, one of the basic elements is the ability to identify emotions, and it is part of the cognitive conceptualization (Beck, 2011, p. 199–200). There are specific references for cases in which patients have difficulty in distinguishing emotions from thoughts and difficulties in labeling emotions (Beck, 2011, p. 162–163). The relationship between emotional understanding and psychological well-being was also a subject for research. For example, patients who suffer from anorexia nervosa show deficits in recognition of facial expressions and deficits in emotion regulation compared with healthy controls (Harrison et al., 2009). In Harrison et al.'s (2009) study, a negative correlation between the ability to recognize emotional expressions and difficulties in emotion regulation was found. In addition, there is a negative correlation between alexithymia (i.e., difficulty to recognize and describe emotions) and reappraisal, suggesting that individuals with high scores of alexithymia tend to use reappraisal less than people with low scores of alexithymia (Swart et al., 2009). In some studies, the relationship between emotion recognition and reappraisal was studied indirectly. For example, Füstös and colleagues (Füstös et al., 2012) found that when using reappraisal, people with high interoceptive awareness, which is related to emotional awareness, showed facilitated downregulation of emotional arousal. In a different study, Samson and colleagues (Samson et al., 2012) found that individuals who suffered from Asperger syndrome or high functioning autism showed higher alexithymia scores (which was interpreted as low labeling ability) and decreased reappraisal frequency and self-efficacy compared with a healthy control group. The relationship between labeling and reappraisal was not tested directly in that study (Samson et al., 2012). Finally, a study by Barrett and colleagues (2001) aimed at investigating the relationship between emotion differentiation and emotion regulation was carried out. In their study, the researchers found that subjects with good emotion differentiation for negative emotions and more intense emotions were more engaged in emotion regulation. However, this correlation was not found for positive emotions. Taken together, these studies strengthen the hypothesis regarding the relationship between emotion recognition and reappraisal, but the causality (i.e., whether high emotion recognition leads to effective reappraisal) has yet to be established.

In most studies, reappraisal and emotion recognition were evaluated as interpersonal factors, while stimulus properties were not taken into account. However, recent studies show that stimuli properties are highly important when choosing an emotion regulation strategy (Sheppes et al., 2011; Suri et al., 2018; Young & Suri, 2020). Sheppes et al. (2011) found that when people are asked to choose whether to use reappraisal or distraction in order to regulate negative emotions, there is a robust tendency to use reappraisal when the emotional intensity is low, but not when the emotional intensity is high. This finding was replicated and was found to be consistent even when participants had external motivation (e.g., money) to prefer one strategy over the other (Sheppes et al., 2014). However, when reappraisal was generated by the experimenter, rather than self-generated, participants tended to choose to use more reappraisal regardless of intensity. Reappraisal affordances (i.e., "the opportunities for semantic re-interpretation that are inherent in a stimulus"; Suri et al., 2018) were also found to be highly relevant when people had to decide whether to use reappraisal. Suri and colleagues found that reappraisal affordances were correlated with stimuli intensity, and when reappraisal affordances were high, people tended to use reappraisal rather than distraction, regardless of intensity levels (Suri et al., 2018). Young and Suri (2020) further assessed the role of multiple predictors of emotion regulation. Their results

showed that greater reappraisal affordances predicted higher use of reappraisal and that stimulus intensity was independently associated with emotion regulation choice. These findings suggest that stimulus properties and the accessibility to possible reappraisals are highly important when one reappraises a negative stimulus.

The aim of the current study was to explore the relationship between reappraisal and emotion recognition by using stimulus properties rather than individual differences. Recently, we developed the Categorized Affective Pictures Database (CAP-D; Moyal et al., 2018) in which pictures are categorized to emotions according to agreement levels. By using agreement levels, it is possible to determine whether a specific picture evokes a specific emotion in high vs. low percentages of the population. We suggest that pictures with high agreement levels provide higher certainty regarding the emotion they evoke compared with pictures with low agreement levels, making the emotion recognition process easier. On the other hand, pictures with low agreement levels might evoke uncertainty regarding the emotion they evoke, making the emotion recognition process more difficult. In the current study, our aim was to understand if reappraisal affordances are influenced by agreement levels regarding the emotional experience evoked by stimuli. In order to assess reappraisal affordances, we used three measures for each picture, as suggested in a previous study (Suri et al., 2018), in order to find the most influential assessment method, that is, reaction time for reappraisal, ratings of difficulty to reappraise, and the number of possible reappraisals. Suri et al. (2018) suggested that measures of reaction times for reappraisal and number of possible reappraisals are problematic in terms of effectiveness of reappraisal, and used only ratings of difficulty to reappraise. To overcome the effectiveness problem, we asked participants to use only reappraisals that changed the emotion they felt or reduced its intensity (i.e., effective reappraisal). According to our suggestion regarding the importance of emotion recognition in reappraisal (Moyal et al., 2014), we hypothesized that pictures with high agreement levels regarding the emotional experience they evoked would also have high reappraisal affordances (as assessed by the measures described above), since the emotion they evoked would be more easily recognized. We also wanted to consider another characteristic of the stimuli—emotional intensity—since emotional intensity is currently the most important indicator in emotion regulation choice (Sheppes et al., 2011). More specifically, we wanted to replicate and extend the findings of Suri et al. (2018) showing that high emotional intensity results in less opportunities to reappraise while pictures with low emotional intensity are easier to reappraise. Hence, we hypothesized that emotional intensity would be negatively correlated with reappraisal affordances. There is a

possibility that these relationships between emotion recognition, emotional intensity and reappraisal affordances will be evident mainly in negative stimuli and not in positive stimuli. This is because our thinking is based on the current literature, which revolves mainly around regulation of negative emotions. There is not enough data regarding the regulation of positive emotions, probably since we are less motivated to regulate positive emotions. However, we find it highly important to discover whether the relationship between emotion recognition, emotional intensity, and reappraisal affordances is similar between negative and positive emotions.

Method

Participants

One-hundred and four students from Ben-Gurion University of the Negev participated in the experiment in return for a small monetary reward. Four participants did not complete the task. Hence, 100 participants (75 females) remained in the sample (mean age 24.92 years, $SD = 1.63$). All participants had normal or corrected-to-normal vision and no reported history of attention deficit disorder.

Apparatus

The experiment was run on an IBM-PC computer with a 22-inch color screen monitor. Open-sesame (Mathôt et al., 2012) was used for programming, presentation of the stimuli and timing operations. Responses were collected using the computer keyboard.

Procedure

Participants were seated in groups of 2–12 in a computer room and signed consent forms. They completed two sessions with a one-week interval between them. Subsequently, participants were randomly assigned to a positive or negative task (i.e., each participant saw only negative or only positive pictures). Verbal instructions were given prior to the beginning of the experiment. Participants were asked to look at the individual pictures that were presented on the screen and press the space key when they thought about the pictures in a different way (i.e., they changed the way they felt about the pictures) or there was a decrease in the intensity of the emotion they felt. Then, participants were asked to rate on a scale of 1 (very easy) to 9 (very difficult), how easy it was for them to change the way they thought about the pictures. Finally, participants were asked to think about
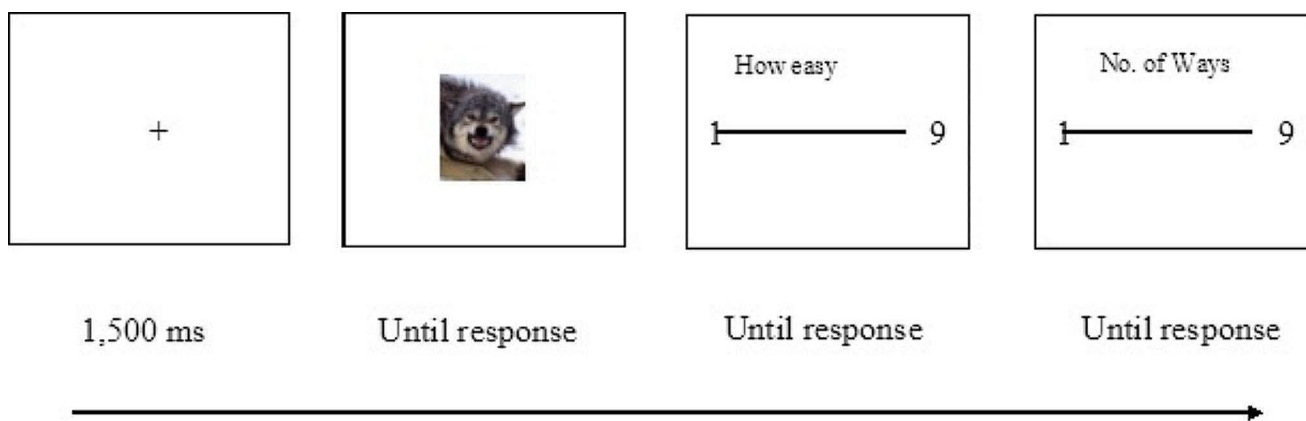
Fig. 1 An example of a trial

Table 1 Descriptive Statistics and Mean Differences Between the Study Variables

Variables	Valence	Mean	SD
Difficulty to reappraise	Positive	4.86	0.35
	Negative	4.82	0.37
RT for difficulty to reappraise (in ms)	Positive	1,649	280
	Negative	1,616	232
RT for reappraisal (in ms)	Positive	8,450	1,394
	Negative	5,034	1,187
Number of possible reappraisals	Positive	1.35	0.15
	Negative	1.23	0.17
RT for number of possible reappraisals (in ms)	Positive	1,086	170
	Negative	997	191

the pictures in other different ways and indicate how many different ways they detected.

Each trial started with a presentation of a fixation cross for 1,500 ms, after which the picture was presented until participants' response. Then, a scale of 1–9 was presented with the question "How easy was it for you to think about the picture in a different way?" followed by a screen with the question "Can you think of more ways to think differently about the picture? Indicate how many ways from 1–9" (for a trial example, see Fig. 1).

Picture stimuli

Five-hundred and twenty-six emotional pictures (318 negative pictures and 208 positive pictures) from the CAP-D (Moyal et al., 2018) were used in the experiment.

Design

There were three dependent variables – reaction times (RT) for reappraising the picture ("press the space key when you think about the picture in a different way that will change the emotion you feel or its intensity"), ratings of difficulty to reappraise, and number of alternative reappraisals for each

picture. Our independent variables were agreement levels and intensity of the pictures.

Results

First, descriptive statistics for the dependent variables are presented in Table 1.

As we can see, the number of possible reappraisals is relatively low, with on average only slightly more than one reappraisal thought. Furthermore, the RT for the number of possible reappraisals on average was one second, which could have limited the formation of more reappraisal ideas. We will elaborate on these results in the discussion section.

Second, we examined the Pearson correlations between the study variables (Table 2).

The correlation between difficulty to reappraise and alternative reappraisals was $r = -.57$, $p < .001$, in the negative task and $r = -.38$, $p < .001$, in the positive task, meaning that the easier it was to reappraise the picture, the more alternative reappraisals were created. Additionally, there is a significant correlation between the RT for difficulty to reappraise and RT for reappraisal in the positive task ($r = .16$, $p < .05$), but not in the negative task ($r = .6$, $p = .3$). In the positive task, the correlation between RT for number of possible reappraisals and RT for difficulty to reappraise was significant ($r = .31$, $p < .001$), and the correlation with RT for reappraisal was also significant ($r = .24$, $p < .001$). In the negative task, there was a significant correlation between difficulty to reappraise and RT for number of possible reappraisals ($r = -.14$, $p < .05$), and there was a significant correlation between RT for difficulty to reappraise and RT for number of possible reappraisals ($r = .22$, $p < .001$). In order to examine the relationship between affordances (as evaluated by our dependent variables) to measures of agreement levels and intensity (as evaluated in previous study of the CAP-D; Moyal et al., 2018), we used a Pearson correlation. We found

Table 2 Person Correlations Between the Study Variables

Variables	Valance	Difficulty to reappraise	RT for difficulty to reappraise	RT for reappraisal	Number of possible reappraisals	RT for number of possible reappraisals
Difficulty to reappraise	Positive	-				
RT for difficulty to reappraise		-0.127	-			
RT for reappraisal		-0.004	0.155*	-		
Number of possible reappraisals		− 0.385**	0.033	0.053	-	
RT for number of possible reappraisals		-0.025	0.310**	0.244**	0.094	-
Difficulty to reappraise	Negative	-				
RT for difficulty to reappraise		0.007	-			
RT for reappraisal		-0.022	0.058	-		
Number of possible reappraisals		− 0.571**	0.080	-0.013	-	
RT for number of possible reappraisals		− 0.135*	0.222**	0.039	0.039	-

Note $*p < .05$, $**p < .01$

Table 3 Reappraisal Affordances as Predicted by Agreement Levels and Intensity

	B	SE	β	t	p
Independent variable					
Agreement levels	-2,731.62	374.47	− 0.36	-7.05**	<0.001
Intensity	223.07	61.44	0.18	3.63**	<0.001

Note $**p < .01$

a significant correlation between the difficulty to reappraise and intensity, $r = .15$, $p = .005$, in the negative task, meaning that the more intense the picture was, the harder it was to reappraise. We also found that in the negative task, there was a significant correlation between RT for reappraisal and intensity, $r = .17$, $p = .001$, meaning that more intense pictures led to longer time to reappraise. As predicted, we also found a negative correlation between RT for reappraisal and agreement levels in the negative task, $r = -.35$, $p < .001$, meaning that higher agreement levels on a picture's category resulted in faster reappraisal. Because we found a significant correlation between RT for reappraisal and agreement levels, and did not find a correlation between other dependent measures (difficulty to reappraise and number of possible reappraisals) and agreement levels, we continued the analysis with RT for reappraisal as a dependent measure, providing us data regarding reappraisal affordances. Hence, we used RT for reappraisal as an indicator for reappraisal affordances. In order to further investigate our hypothesis regarding the relationship between reappraisal affordances, agreement levels, and emotional intensity, we conducted a multiple regression analysis. Before inserting both agreement levels and intensity into the regression, we assessed the correlation between them to avoid multicollinearity. The correlation between agreement levels and intensity was not significant, $r = .02$, $p = .67$. Hence, we included these two predictors in the multiple regression, with RT for reappraising as a dependent variable. As predicted, both agreement levels and intensity predicted RTs for reappraisal. Higher agreement levels predicted shorter RTs for reappraisal, β =

-0.36, $t = -7.05$, $p < .001$. In addition, higher intensity predicted longer RTs for reappraisal, $β = 0.18$, $t = 3.63$, $p < .001$ (see Table 3). This model accounted for 16.4% of the variance, $F(2, 315) = 30.85$, $p < .001$.

For the positive pictures task, none of the correlations found in the negative pictures task were found.

Discussion

Let us first summarize the results:

1. In the negative task, RTs for reappraisal are predicted by both agreement levels and intensity.
2. There is a positive relationship between difficulty to reappraise and intensity in the negative task.
3. We did not find any correlation between our dependent variable of number of reappraisals and our independent variables – agreement levels and intensity.
4. We did not find any correlation between measures of reappraisal affordances and agreement levels and intensity in the positive task.

In the descriptive statistics (Table 1), it appears that the number of possible reappraisals was overall very low (on average, only slightly over one reappraisal thought, with a low standard deviation) for the positive and negative tasks. Furthermore, the RT for the number of possible reappraisals on average was one second, which could have been too short to create various reappraisal ideas. These results could be explained in several ways. First, some of the pictures in the CAP-D are very intense and could be uncomfortable to watch, let alone reappraise. Hence, most of the participants probably rushed through these pictures. In the introduction, we mentioned that in previous studies, researchers have indicated that reappraisal effectiveness can depend on affective intensity. For example, Sheppes et al. (2014)

proposed that healthy individuals prefer to use reappraisal with low-intensity emotional situations and distraction with high-intensity situations, and Sheppes and Gross (2011) found that high-intensity negative situations are harder to reappraise. Second, there is a possibility that the participants simply rushed to the next picture after they found one way to reappraise the picture (in the positive pictures). This outcome could be explained by the construct of reappraisal inventiveness, which is the ability to create multiple and differing reappraisals (Weber et al., 2014). In their study, Weber et al. (2014) suggested that it is related to cognitive flexibility and creative ideation. Furthermore, they argued that the ability to generate many different perspectives may surface only when people are motivated to act upon their ability to generate different reappraisals. Finally, they speculated that individuals with higher reappraisal inventiveness would be better prepared to generate effective reappraisals spontaneously. However, there is an ongoing debate concerning the benefits of reappraisal inventiveness as Zeier et al. (2020) suggested that a large number of alternative reappraisals may not be beneficial for the reappraisal process. For example, they explain that high inventiveness scores may result from creative but unrealistic reappraisal thoughts. They concluded that effective reappraisal would depend on the quality rather than the quantity of reappraisal ideas.

Our results regarding the relationship between the difficulty to reappraise and picture intensity are consistent with Suri et al.'s (2018) findings. In addition, our results show that reappraisal affordance, as measured by RTs of reappraisal, is affected by both agreement levels regarding the emotional category and picture intensity. These results are in accordance with our suggestion that emotion recognition is of importance for reappraisal. Our results further suggest that when the dominant emotion that is evoked in response to a stimulus is clear, we are able to create effective reappraisals faster, even when emotional intensity is held constant. These results are in accordance with our suggestion regarding the importance of emotion recognition in reappraisal (Moyal et al., 2014). We suggested that when one recognizes their emotions, reappraisal is more accessible and beneficial, since it targets the specific emotion that is evoked. In the CAP-D database (Moyal et al., 2018), higher agreement levels imply that most of the participants chose the same emotional category for a picture. In our study, we used those agreement levels in order to measure emotion recognition. Because we focused in this study on the features of the stimulus and not individual differences in the ability to recognize emotional categories, it is plausible to use the agreement levels as an indirect measurement of emotion recognition. Interestingly, the contribution of intensity to the model was smaller than agreement levels were.

These findings have clinical implications for psychological treatment. When the emotion that is evoked is clear, there are more opportunities for semantic re-interpretation of the situation even in high intensity emotions, turning emotion regulation via reappraisal more accessible. Our findings highlight the potential benefits of affect labelling in psychological treatment as they facilitate reappraisal of high intensity emotions. Our findings also suggest an explanation for the difficulty of individuals who suffer from alexithymia to use reappraisal (Swart et al., 2009). It is possible that for individuals with high alexithymia, semantic re-interpretation is not accessible since it is harder for them to recognize the emotion that is evoked in them. It is possible that this difficulty in the recognition of emotions makes it harder for them to choose to use reappraisal, since it is not clear to them what they should reappraise.

In our results, we mentioned that the number of possible reappraisals and the difficulty to reappraise were negatively correlated in the negative task and the positive task. This means that as the pictures were more difficult to reappraise, the less the participants could make alternative reappraisals. A possible explanation is that when a picture is more intense, the ability to reappraise the situation is more difficult (e.g., Sheppes & Gross, 2011). Additionally, in the negative task, we found a significant negative correlation between difficulty to reappraise and RT for the number of possible reappraisals. This means that when it was difficult to make alternative reappraisals, the participants had to think longer for them. One might ask about the lack of relationship between RTs for reappraisal and subjective ratings of difficulty to reappraise. It is possible that the subjective experience of difficulty to reappraise is dissociated from the objective measure of RTs. Different studies found dissociations between self-report measures and objective measures (e.g., heart rate, skin conductance; Kircanski et al., 2012; Niles et al., 2015). Although in these studies the objective measures were physiological, they clearly show the dissociation between subjective experience and objective measures. Hence, it might be that the subjective measure of difficulty to reappraise is influenced mainly by the intensity of the emotional stimuli, while the objective measure of RTs to reappraise is more reliable and is affected also by agreement levels, which reflect emotion recognition.

For positive stimuli, we did not find a relationship between emotion recognition, emotional intensity and reappraisal affordances. We asked participants in both experiments (negative and positive) to try to think about the picture in a way that changes the emotion they feel or makes it less intense. Hence, this finding is not surprising, since participants had no motivation to reappraise their positive feelings. In addition, our findings are in line with a previous study that found a relationship between emotion recognition

and emotion regulation in negative emotions but not in positive emotions (Barrett et al., 2001).

Our study has a few limitations. First, we did not assess whether agreement levels predict the ability to recognize the emotion evoked by pictures in our database, although we used agreement levels as a measure for how easy it is to recognize emotions. However, previous research has used agreement scores (e.g., Kappa scores) in order to validate the use of facial expressions (Biehl et al., 1997; Tottenham et al., 2009) when testing emotion recognition. In these studies (Biehl et al., 1997; Tottenham et al., 2009), agreement scores were used as a measure for difficulty to recognize emotions. Hence, our use of emotion recognition is based on the assumption that regardless of individual differences in ability to evaluate the emotion that is evoked from a stimulus, higher agreement levels extend the probability of choosing a specific emotion for a particular stimulus. Another limitation is that we did not assess reappraisal effectiveness. Future studies should consider measuring reappraisal effectiveness and not rely solely on participant reports. Finally, in our experiment, the participants did not have the possibility to not reappraise the situation (i.e., to choose zero reappraisals). The reasoning for this choice was to preclude participants from skipping pictures that might have been harder to reappraise (e.g., pictures depicting situations of high intensity), and thereby lose a lot of valuable information.

Lastly, Suri et al. (2018) demonstrated the incremental value of self-reported reappraisal affordance over intensity. In our study, we used three measurements of reappraisal affordance: one objective—RT, and two subjective—difficulty to reappraise and number of reappraisals. In line with Suri et al.'s findings, an alternative explanation is that intensity alone (and not agreement level) affects reappraisal affordances. In Table 2 we can see that the correlations between the different reappraisal affordances are low or not significant (agreement levels affects RT but not other self-report measurements). This suggests that they measure different aspects of this construct. Hence, future research should further investigate the implications of using various measurements to assess different elements of this construct; for example, as we mentioned earlier, with reappraisal inventiveness (Weber et al., 2014).

To summarize, the current study aimed at examining the relationship between emotion recognition and reappraisal by using stimulus properties rather than individual differences. The findings of the current study strengthen our previous hypothesis regarding the relationship between emotion recognition and reappraisal (Moyal et al., 2014) and provide evidence for the role of emotion recognition in reappraisal affordances. The implications of this study are relevant for both studies in the field of emotion regulation

and for psychotherapy. The role of emotion recognition in reappraisal should be taken into consideration when studying reappraisal, especially with clinical subjects, and also in psychotherapy as the basis for interventions aimed at increasing the use of reappraisal in therapy and in daily life.

Declarations

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