



Is elaboration of affective content sufficient to attenuate emotional responses during reappraisal procedures?



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ABSTRACT

Reappraisal is an emotion regulation strategy which involves changing the interpretation of emotional stimuli. It decreases measures of negative affect together with markers of emotional processing, including late positive potential (LPP). Affective responses can also be attenuated by various cognitive tasks. As reappraisal tasks require cognitive effort to elaborate emotional stimuli, it is possible that the observed reduction of the LPP amplitude during reinterpretation is, at least partly, caused by an unspecific cognitive activity. The aim of the study was to examine, whether mental activity other than cognitive change carried out directly on affective stimuli can be a factor that significantly modifies the intensity of the emotional responses. Three groups took part in an experiment with standardized emotional pictures: a reappraisal group (trained in reinterpretation), a retro group (trained in cognitive elaboration of emotional stimuli other than cognitive change), and a control group (passive viewing). The early LPP potential showed a main effect of group with the highest amplitude in the control group and the lowest amplitude in the reappraisal group. The retro group revealed no significant differences comparing with the other two groups. The late LPP was indistinguishable in the reappraisal and retro groups, which showed an equal decrease in its amplitude compared to the control group in the case of negative stimuli. Conversely, behavioral ratings collected in a separate group of subjects showed a decrease in negative feelings in the reappraisal group only. We conclude that the LPP component during reappraisal is under additive influence from the cognitive change itself and from unspecific cognitive activity; however, both of them differ in regard to their temporal characteristics.

1. Introduction

Reappraisal is a strategy used to decrease the intensity of affective responses by conceptually reinterpreting the meaning of the emotionally arousing stimuli (Ochsner & Gross, 2005). This requires a cognitive effort to change one's perspective to a more neutral one, or imagine a positive or less serious outcome of a potentially negative situation (e.g. "I am watching this operation as a surgeon paying attention to the technical details", or "Despite the fact that this accident looks quite serious, all involved people were only slightly hurt"). Such a cognitive change in the affective value of the stimuli is usually considered as a basic cause of attenuation in subsequent emotional responses. However, the cognitive change constitutes only the final stage of the whole chain of processes recruited during reappraisal tasks. Before it can be performed, a complex cognitive involvement to elaborate emotional material is required. Namely, the emotional pictures (or other affective stimuli) have to be attentively watched, understood, then a new interpretation has to be found and applied.

Since virtually any form of cognitive activity can, in an unspecific manner, decrease the intensity of affective reactions, we hypothesize that the activity that accompanies cognitive change in typical reappraisal tasks may serve as an important factor underlying affective down-regulation. Therefore, two factors can contribute to the observed attenuation of emotional responses: i) the general cognitive activity which must accompany typical reappraisal tasks, and ii) the cognitive change itself which brings a new interpretation of the affective situation. As the latter is obviously intended and evoked by researchers, the impact of the former is often neglected. In the present study, we investigate the unspecific impact of accompanying cognitive activities (which are necessary to formulate affective reinterpretation) on emotional responses. 'Unspecific' means that the emotional processing is affected not by the new, reappraised view of the emotional situation, but rather by more general cognitive involvement.

Tasks that involve reinterpretation of negative content are frequently shown to decrease the late positive potential (LPP; Gan, Yang, Chen, & Yang, 2015), which is considered to be a marker of the actual

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depth of processing of the motivationally salient stimulus, starting around 300–500 ms after stimulus onset (Schupp et al., 2000). Interestingly, LPP decreases not only during reinterpretation of unpleasant stimuli but also during passive watching when an additional task is imposed. It has been shown that even in tasks as easy as labeling of emotional faces, the LPP amplitude decreases compared to passive viewing (Herbert, Sfaerlea, & Blumenthal, 2013). Moreover, labeling pictures along the non-affective dimension (counting people in a picture) affects the LPP to a greater extent than using the affective dimension (deciding whether a picture was pleasant or unpleasant) (Hajcak, Moser, & Simons, 2006). Other studies confirm that unspecific cognitive involvement may decrease the LPP component during viewing unpleasant pictures. In one task, participants had to memorize either six (high load) or two (low load) letters (MacNamara, Ferri, & Hajcak, 2011). This task was interspersed with the subjects being shown task-irrelevant pictures. The LPP for the pictures was greater during the trials with a low load than during trials with a high load. Other studies have replicated this effect and shown that working load effects are not related to the avoidance of pictures (MacNamara & Proudfit, 2014). Similar conclusions can be drawn from the study of (Van Dillen & Derks, 2012), where participants judged the gender of emotional faces and, at the same time, mentally rehearsed previously presented digits. High load (eight digits) reduced the LPP amplitude and eliminated the enhanced LPP to negative faces in comparison with positive faces.

It is plausible to assume that reappraisal procedures involve significant amounts of cognitive processes other than cognitive change itself. As these processes are capable of reducing the emotional response due to the cognitive involvement they induce, it is important to take into account their contribution to the overall attenuating effect visible in reappraisal procedures. Among these accompanying processes, we may differentiate those relating to the affective content (the emotional material has to be recognized and elaborated, with understanding of the depicted scenes), or to the instruction itself (which relates mostly to: executive functions, where the instruction has to be kept in working memory; and the goals that have to be established and achieved – with the monitoring processes recruited). As can be seen, the conceptual reinterpretation of the emotional content is one of the final stages of the reappraisal task. Surprisingly, despite its importance, which relates to the very foundations of the reappraisal mechanism, the above issue has hardly been studied.

In typical experimental procedures, the control condition is frequently based on passive attending of stimuli (Ligeza, Wyczesany, Tymorek, & Kamiński, 2016). In such cases subjects are often not provided with any particular task and their perceptual involvement is lower than in the reappraisal task. Hence, when reappraisal conditions are compared to passive watching, they differ not only in terms of the cognitive change, but also (in terms of) numerous cognitive processes, which are exclusively or more strongly recruited in active reappraisal conditions. We argue that the conclusions drawn from such comparisons may be flawed, as they do not account for the increased cognitive involvement necessary to prepare and formulate a new interpretation. An attempt to disentangle the role of other factors in reappraisal was made in a study by Foti and Hajcak (2008), where the possible effects of cognitive load as a factor attenuating emotional responses were investigated. Before the stimuli were presented, subjects were given either negative descriptions or more neutral, reappraised interpretations. Such a design was aimed at balancing the conditions according to the cognitive load. As a result, attenuation of the LPP was visible in the reappraisal compared to the negative condition. It was concluded that the cognitive change of the meaning is the factor underlying the attenuation of the emotional processing, while increased cognitive load related to the effort of reinterpretation did not play a role. Although the study confirmed that cognitive change is an important factor reducing negative emotions in reappraisal, little is known whether additional cognitive activity associated with generating new emotional interpreta-

tions may further decrease emotional processing.

Our study attempts to fill this apparent methodological gap by determining whether mental operations other than cognitive change carried out directly on the content of negative stimuli can be a factor that significantly modifies the intensity of the emotional responses. Therefore, we designed a ‘retro’ task which was similar to the typical reappraisal task with regard to the cognitive involvement. The most important difference between the tasks was the absence of cognitive change of emotional content in the retro task. In this case, the operation of reappraisal was substituted by imagining what had happened just before the emotional slide was taken. To keep the tasks similar, in both cases subjects had to watch the same set of pictures and analyze them to understand the meaning of the scene. As a result, the difficulty of both reappraisal and retro tasks as well as the cognitive load associated with them were equated to the extent possible. Moreover, both tasks were similar in terms of linking them to the elaboration of the pictorial content.

It should be emphasized that this made our procedure different from studies which were designed to test the influence of the cognitive load by competing with the main reappraisal task. In the present study, we focus on the activity being an inherent part of the reappraisal process. In parallel tasks, the subjects either had to (reappraisal) or did not have to (retro) cognitively change the meaning of the scene; however, in both cases the form and degree of unspecific cognitive elaboration performed on the emotional stimuli was comparable. Such a design provided a novel approach to verifying the influence of specific (reappraisal) and unspecific cognitive factors in attenuating emotional responses. As the reappraisal and retro tasks were designed as a between-subject factor, no switching between or intermixing of these two strategies could take place. Similarly to other studies, we used the LPP component to monitor the depth of the emotional processing, as well as behavioral measures for assessing subjective experience evoked by experimental stimuli. As the effects of our experimental task were expected to develop over time, we analyzed it in a longer time window but divided into shorter time bins. This was because the LPP can be considered to be functionally heterogeneous, marking different stages of emotional processing (attentional deployment followed by evaluative processes; Thiruchselvam, Blechert, Sheppes, Rydstrom, & Gross, 2011). Precise time boundaries, however, are generally not agreed (Bamford et al., 2015; MacNamara et al., 2011).

We expected an early effect of group on P1 and N1 components, with higher amplitudes for both REAP and RETRO groups relative to the control group, which would reflect the attentional bias related to the active task associated with the content elaboration. The LPP amplitudes were hypothesized to show the main effect of valence (NEG > NEU), marking the emotional value of stimuli. Importantly, the interactive effect with group differences would be visible only for emotional (NEG) slides, where the REAP group would show the strongest attenuation of the LPP amplitudes as a result of cognitive elaboration together with reinterpretation of the negative content. In the RETRO group, a weaker attenuation effect for negative content was also expected relative to the REAP group, since the cognitive activity itself would have some modulatory effect on emotional processing. As the early and late LPP components are suggested to show some functional discrepancy, they were analyzed separately to reveal possible differences in the dynamics of emotional modulation.

Additionally, the early P1 and N1 components were analyzed to monitor the initial stages of perceptual processing which could indicate attentional bias related to task involvement. Both the reappraisal and retro task should increase the amplitude of these components, since they both require the subjects to direct their attention towards upcoming stimuli to perform the experimental task. To check if these attentional involvements are similar in terms of both tasks, we measured early ERPs. The P1 and N1 components originate in the secondary visual cortex and are most pronounced over the occipital electrodes. They reflect early attentional processes including orienting

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