

The role of executive functions in emotion regulation

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Summary We examined the relationship between executive functions and emotion regulation. Participants completed updating, shifting and inhibition tasks. Then they used suppression or reappraisal strategies in response to unpleasant pictures. Faster updating was associated with a larger HR change during reappraisal. Inhibition was associated with a more frequent use of suppression. Finally, inhibition rate was related to a larger HR change during reappraisal.

Keywords · executive functions · reappraisal · suppression · emotion regulation · psychophysiology

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Introduction Emotion regulation (ER) involves the processes and strategies that are adopted to influence the experience and expression of emotions. Cognitive reappraisal and expressive suppression received considerable attention in research. ER may be influenced by cognitive processes such as executive functions (EF). Here, we narrow EF to include updating, inhibition and shifting. Although an attempt has been made to examine how EF relates to ER, not much is known about the relative contribution of the 3 EF in the successful implementation of ER strategies. While some studies found a link between updating and ER (Sperduti et al., 2017), others did not (Gyurak et al., 2012). Many studies (e.g., Sperduti et al., 2017) found no link between inhibition and ER, but one study found a negative relationship between inhibition cost and ER after a training (Cohen & Mor, 2018).

Aims To examine the role of EFs in the successful implementation of ER strategies. Both non-affective and affective stimuli were used in the tasks to assess EF. To assess successful ER strategies (i.e., reappraisal and suppression), a questionnaire, an ER task and physiological measures including corrugator and zygomatic electromyography (EMG), heart rate, electrodermal activity (EDA) were used. We hypothesized that each of the EF would be related to the ER strategies.

Methods Seventy-nine healthy participants (68.4% females), with mean age of 20.32 ($SD=3.68$) took part in the experiment. The n -back ($n=2$), Stroop and the letter-number tasks were used to measure updating, inhibition and shifting, respectively. Participants completed first the three EF tasks followed by the Gross ER questionnaire. Then participants were presented with neutral and negative pictures from IAPS and asked to

rate how negative they felt after watching each picture under three conditions of ER.

Results

The results of the Spearman ranked correlation showed that greater speed of updating was associated with greater change in HR deceleration using reappraisal strategy (.249). Inhibition (using neutral and affective Stroop tasks) was associated with greater frequent use of suppression (.246, .264). Finally, emotional inhibition rate was also related to higher change in HR using reappraisal strategy (.261).

Conclusions Our results suggest that updating is related to reappraisal measured with HR deceleration. That is people, who updated better, were more effective in using reappraisal. This finding is novel and extends the growing body of research examining how updating relates to reappraisal. Again, we found that cost of inhibition was related to frequency of the use of suppression as predicted. That is people, who performed better at inhibition tasks, were more effective in using reappraisal, but at the same time, used suppression more frequently in their daily life. Overall, these data confirm the idea that a higher level of executive functions is partially related to the efficient application of emotion regulation strategy. As to other physiological measures, although typical patterns of emotional responding were observed, they did not correlate with the EF measures during the application of the ER strategies.

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