



## A preliminary investigation of sex differences in associations between emotion regulation difficulties and higher-order cognitive abilities <sup>☆</sup>

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### ABSTRACT

The present study sought to clarify the cognitive correlates of emotion regulation difficulties (ERD). Further, because prior evidence suggests sex differences in emotion regulation, sex was examined as a moderator of associations between cognitive abilities and ERD. Participants ( $N = 154$ ) completed self-report measures of ERD, and were administered neuropsychological tests assessing crystallized and fluid intelligence, as well as various components of executive functioning. Bivariate correlations and results from regression analyses suggested sex-dependent associations among cognitive processes and ERD. For men, inhibition of dominant response tendencies was associated with lower ERD, whereas for women, a host of executive abilities (e.g., greater inhibition, cognitive flexibility, semantic processing, abstract reasoning) were associated with greater ERD. Implications for the neurocognitive conceptualization of emotion dysregulation will be discussed.

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### 1. Introduction

Executive functions – a wide range of top-down cognitive processes (e.g., response inhibition, cognitive flexibility, strategy formulation) – are associated with the modulation of bottom-up responses to emotion-laden information. For example, executive processes have been linked to the regulation of trauma-related distress (Bardeen & Read, 2010) and startle reflexes to rejection stimuli (Gyurak & Ayduk, 2007). Moreover, some cognitive emotion regulation strategies have been shown to be associated with components of executive functioning. For example, Gyurak et al. (2009) found that among a variety of executive processes, greater cognitive flexibility, measured via verbal fluency, was associated with less physical responding to startle cues (loud noises) when participants were instructed to suppress their somatic reactions. Further, McRae, Jacobs, Ray, John, and Gross (2012) found that the use of cognitive reappraisal as an emotion regulation strategy was associated with relatively higher working memory capacity, shifting abilities, and abstract reasoning, but not with response inhibition or

verbal fluency. These findings suggest that the ability to effectively regulate emotion may be related to specific cognitive abilities.

Interestingly, although it seems to make intuitive sense that higher-order cognitive abilities would be positively related to the capacity to flexibly regulate emotion, and some research is consistent with this proposition (e.g., Welborn et al., 2009), there is evidence to the contrary. Shamosh and Gray (2007) examined associations among fluid intelligence, emotion suppression, and self-regulatory depletion in a sample ( $N = 58$ ) of undergraduate students. Among participants who were instructed to suppress emotional reactions to the viewing of a sad video, individuals with relatively higher fluid intelligence showed greater depletion of cognitive resources following the task, and no differences in actual suppression ability were observed. Shamosh and Gray (2007) suggested the possibility that higher-order cognitive abilities may not predict one's ability to regulate emotion, rather, such abilities predict the degree to which cognitive resources are employed, with those with relatively higher fluid intelligence expending more resources, thus resulting in greater resource depletion following attempts to regulate emotion.

In a similar vein, Beilock and Carr (2005) found that participants ( $N = 93$ ) with higher working memory capacity performed less well on arithmetic problems, in comparison to those with lower working memory capacity, but only in a high pressure condition (i.e., peer pressure and social evaluation). Results suggest that cognitive resources were taxed to a greater extent by self-regulatory attempts among those with higher working memory capacity when

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under pressure, thus leaving relatively fewer available resources for task success. Similarly, DeCaro, Thomas, and Beilock (2008) suggested that individuals with higher levels of executive resources may have impaired performance and learning during certain tasks because they expend a larger amount of cognitive resources than is necessary, perhaps by using advanced strategies when simpler, less taxing strategies, would suffice.

The role of sex in cognitive ability–emotion regulation associations has yet to be examined. This is especially important because a variety of sex differences have been found in emotion regulation (e.g., Nolen-Hoeksema, 2012; Zlomke & Hahn, 2010). Furthermore, although women are more likely than men to report engaging in emotion regulation strategies, differential strategy use has been observed. The most pronounced difference in strategy use between men and women is that women tend to use rumination far more than men (for a review see Tamres, Janicki, & Helgeson, 2002), whereas men are more likely to use emotion suppression (Gross & John, 2003). Moreover, women are more likely than men to attend to, analyze, and engage in conscious attempts to regulate emotion (Nolen-Hoeksema, 2012).

Neural evidence of sex differences in emotion regulation is consistent with these findings. Specifically, when asked to down-regulate emotional responses through the use of cognitive reappraisal, women demonstrated greater activation in the prefrontal cortex (PFC), but failed to surpass men in the down-regulation of amygdala activity (McRae, Ochsner, Mauss, Gabrieli, & Gross, 2008). McRae et al. (2008) suggested that men may be more efficient in the down-regulation of negative emotion because they require relatively less cognitive resources to do so. Thus, the regulatory depletion effect described above may be particularly applicable to women. That is, evidence suggests that women use higher-order cognitive abilities to a greater degree than men when attempting to regulate negative emotions, and therefore, women may have fewer resources available when faced with tasks that require prolonged use of higher-order cognitive processes (e.g., repeated or prolonged stressors). Given the above, it is important to account for sex when examining relations among emotion regulation and higher-order cognitive abilities.

Although there is a lack of consensus regarding the definition of emotion regulation, it seems clear that the construct of emotion regulation, in its entirety, must account not only for strategies, but also for other processes which impact emotional responding. For example, before one can employ an emotion regulation strategy, one must first be able to identify the experience of emotion. As described by Gratz and Roemer (2004), emotion regulation is the ability to monitor, evaluate, and modify emotional experience in accordance with one's desired goals.

This conceptualization suggests multiple distinct, albeit related, domains of emotion regulation including awareness and clarity of emotional responses, acceptance of emotional reactions, access to effective emotion regulation strategies, and control of impulses and engagement in goal-directed behaviors when experiencing negative emotions (Gratz & Roemer, 2004). From this definition, Gratz and Roemer (2004) developed a comprehensive measure of emotion regulation; the Difficulties in Emotion Regulation Scale (DERS) accounts for six dimensions of emotion regulation.

Emotion regulation difficulties (ERD) may result in a wide variety of consequences, some being relatively benign (e.g., social awkwardness resulting from an inability to inhibit socially inappropriate emotional responding), and others which are associated with severe impairment (e.g., borderline personality disorder, generalized anxiety disorder, depression, alcohol dependence; Fox, Hong, & Sinha, 2008; Gratz, Rosenthal, Tull, Lejuez, & Gunderson, 2006; Salters-Pedneault, Roemer, Tull, Rucker, & Mennin, 2006; Tull, Stipleman, Salters-Pedneault, & Gratz, 2009). Given the potential transdiagnostic applicability of ERD, the importance of pursuing

research to better understand the cognitive correlates of ERD cannot be overstated. Moreover, an examination of the higher-order cognitive processes associated with the broad construct of ERD has yet to be conducted, and thus, the purpose of the present study was to identify differential associations among cognitive abilities and ERD.

As suggested by Shamosh and Gray (2007), in their attempts to regulate emotion, individuals with relatively higher cognitive abilities may expend more resources, thus resulting in greater resource depletion and leaving one with fewer resources available when faced with tasks that require prolonged use of higher-order cognitive processes (e.g., repeated or prolonged stressors). Evidence suggests that women attempt to regulate their emotions more than men (Nolen-Hoeksema, 2012) and use higher-order cognitive abilities to a greater degree than men when regulating negative emotions (McRae et al., 2008). Thus, women may be particularly prone to resource depletion following attempts to regulate emotion. On the other hand, men may be more efficient in down-regulating negative emotion because they require relatively less cognitive resources to do so (McRae et al., 2008).

Consistent with this rationale, we broadly predicted that higher levels of higher-order cognitive abilities would be associated with greater ERD among women, but not men. Moreover, men are significantly more likely to use expressive suppression to regulate emotion than women (Gross & John, 2003). Thus, we predicted that higher inhibition abilities would be associated with lower ERD among men. Because women are more likely than men to attend to and analyze their emotions (Barrett & Bliss-Moreau, 2009; Nolen-Hoeksema, 2012), and use rumination as a regulatory strategy when distressed (Tamres et al., 2002), we predicted that women with greater cognitive flexibility, semantic processing, and abstract reasoning abilities would have greater ERD, which, as described above, may be a consequence of resource depletion

## 2. Method

### 2.1. Participants and procedure

Participants for this institutional review board approved study were introductory psychology students, over the age of 18, recruited from a mass testing pool at a mid-sized University in the Midwest. Data was collected over two assessment sessions conducted between 2 and 10 days apart. At session one, participants ( $N = 225$ ) provided informed consent and then completed a battery of self-report questionnaires administered via a desktop computer in a private room. At session two, participants were administered a variety of measures of cognitive and executive functioning. From those who attended both sessions ( $n = 169$ ), the data from participants who were not fluent in English ( $n = 5$ ), or for whom data collection was incomplete ( $n = 10$ ), was removed from reported analyses. The final sample ( $N = 154$ ; 82 women) had an average age of 19.7 years ( $SD = 2.1$ ), and 69% self-identified as White, 21% as Black, 5% as Asian, 3% as Multi-racial, and 1% endorsed "other". Regarding ethnicity, 10% of participants identified as Hispanic or Latino. For their participation, students received partial course credit toward their undergraduate psychology course.

### 2.2. Measures

#### 2.2.1. Emotion Regulation Difficulties

The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) is a 36-item self-report measure used to assess six dimensions of emotion regulation: Nonacceptance of Emotional Responses (Nonacceptance; e.g., *When I'm upset, I feel guilty for feeling that way*), Difficulty Engaging in Goal-Directed Behavior (Goals;

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