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Time to Set a New Research Agenda for Ego Depletion and Self-Control

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Time to Set a New Research Agenda for Ego Depletion and Self-Control

The conceptualization of self-control capacity as a domain-general limited resource, and the accompanying state of low self-control resource, known as the *ego depletion* effect, has received considerable attention in social psychology literature. The effect has also been widely publicized in popular media largely due to its elegant simplicity and intuitive appeal. Since its inception (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Muraven, Tice, & Baumeister, 1998), the ego depletion effect has been a 'hot' topic of research and has stimulated hundreds of laboratory studies testing the effect (Hagger, Wood, Stiff, & Chatzisarantis, 2010).

The effect has, however, stoked considerable controversy regarding its replicability after meta-analytic research suggesting possible publication bias (Carter, Kofler, Forster, & McCullough, 2015) and a recent multi-lab registered replication finding an effect size that was no different from zero (Hagger et al., 2016). This replication led other groups to conduct multi-lab replication studies, which have demonstrated non-zero effects for ego depletion, albeit ones that are substantially smaller than those found in the original meta-analytic study (Dang et al., 2019; Vohs, 2018) and, in one recent replication, an extremely small effect size with Bayesian analyses indicating that the effect is four times more likely under the null than under the experimental hypothesis (Vohs, 2018). In fact, recent analyses included in the current special issue suggest that the decline in the size of the ego

depletion effect is merely a function of increases in study precision and the publication of less biased research (Vadillo, 2019).

In addition, there have also been controversies over the conceptual basis of the self-control failures observed in ego depletion experiments. The original explanation for the ego depletion effect, the limited resource or 'strength' model, has been challenged because of difficulties in reconciling it with recent findings (Dang, Björklund, & Bäckström, 2017; Inzlicht, Schmeichel, & Macrae, 2014; Kurzban, Duckworth, Kable, & Myers, 2013).

These controversies inspired our proposal of this special issue on ego depletion and self-control. The special issue brings together research in the field of ego depletion with the goal to shed light on important questions arising from the issues of bias and replicability of the ego depletion effect, and to address some of the key conceptual issues regarding mechanisms. In this editorial we raise some of the key issues in the field of ego depletion, outline how recent research, including studies included in the current special issue, have sought to address them, and make suggestions on how the field can be advanced.

Addressing Replication Issues

In response to issues around replication, researchers have started to systematically test the replicability of the ego depletion effect in high-powered experiments, with most of them adopting the sequential task paradigm, the between-participants experimental design traditionally used to

test the ego depletion effect (for a list of the most frequently used tasks, see Carter et al., 2015; Dang, 2018). In the sequential task paradigm, participants are randomly assigned to two conditions, a depletion condition and a control condition. Both sets of participants are required to complete two tasks sequentially. For participants allocated to the depletion condition, the first task requires effortful self-control whereas the task for participants assigned to the control condition has no or minimal self-control demand. In both conditions participants then move forward to a second, unrelated self-control task. Participants in the depletion condition generally perform worse than those in the control condition, which is referred to as the ego depletion effect (Baumeister, Bratslavsky, Muraven, & Tice, 1998).

The results of these recent tests have not resulted in conclusive evidence for the effect. For example, several projects have focused on the 'letter-crossing' task, a task that has been used extensively in the literature, including Hagger et al.'s (2016) RRR. Although some studies reported a non-zero but small effect size of ego depletion when the letter-crossing task was combined with the Stroop task as the outcome task (Singh & Göritz, 2019; Wimmer, Stirk, & Hancock, 2017), others using this combination found effects that were no different from zero, even if the difficulty of the letter-crossing task was manipulated (Wimmer, Dome, Hancock, & Wennekers, 2019) and a habituation phase was added (Alós-Ferrer, Ritschel, García-Segarra, & Achtziger, 2018) as suggested by Baumeister and Vohs (2016). Similarly, studies that employed other depleting tasks also yielded results

from which no definitive conclusion could be drawn, with some studies reporting substantive, non-zero effects (Bayer & Osher, 2018; Dang, Liu, Liu, & Mao, 2017; Garrison, Finley, & Schmeichel, 2019) while others reporting effects that were no different from zero (Etherton, Osborne, Stephenson, Grace, Jones, & De Nadai, 2018; Lurquin et al., 2016; Singh & Göritz, 2018).

In addition, given issues around small sample sizes and statistical power associated with studies using the typical between-participants version of the sequential task experimental paradigm, researchers have also examined whether within-participants versions of the paradigm are more effective in evoking stable ego depletion effects due to the increased statistical power of this design. These attempts yielded similar results such that the effect was either no different from zero or very small in size (Francis, Milyavskaya, Lin, & Inzlicht, 2018; Radel, Gruet, & Barzykowski, 2019). One of the limitations of these designs was that the practice effect might overwhelm any intended depletion effect, even if the two sessions were separated by an extended interim period such as two weeks (Wenzel, Lind, Rowland, Zahn, & Kubiak, 2019).

Why is there such high heterogeneity in the size of the ego depletion effect across studies? We suggest two important aspects that have been overlooked in ego depletion literature. First, little attention has been paid to ascertaining participants' engagement in the depleting task beyond subjective assessments of effort and fatigue (Friese, Loschelder, Gieseler, Frankenbach, & Inzlicht, 2019; Lee, Chatzisarantis, & Hagger, 2016).

Researchers adopting the sequential task paradigm generally assume that participants would invest sufficient effort on the depleting task to evoke depletion. However, participants in depletion experiments may not be sufficiently engaged or motivated to engage in the tasks, or may be in different states of fatigue when they arrive in the lab. Without sufficient controls over these variables, variability in effort and current fatigue may mask an already 'fragile' effect. Second, even if all participants were fully engaged in the depleting task, their real-time responses to a brief demanding task lasting for a such a short period (i.e., generally less than ten minutes in ego depletion research) could vary substantially, with some participants feeling exhausted while others feeling indifferent or even excited as such tasks may serve to 'warm-up' their self-control (c.f., Converse & DeShon, 2009; Xiao, Dang, Mao, & Liljedahl, 2014). These factors may explain the substantive heterogeneity and inconsistent effects observed in ego depletion literature. Future studies may consider the systematic exploration of different depleting tasks, or task durations (e.g., first tasks lasting for half hour or more), as means to evoke ego depletion, especially for those who devote higher engagement in the depleting task. Several recent attempts are consistent with this suggestion (Brown & Bray, 2017; Lopez, Courtney, & Wagner, 2019; Palma, Segovia, Kassar, Ribera, & Hall, 2018; Tsai & Li, 2019).

Addressing Conceptual Issues

One of the elegant, but controversial, aspects of the research that introduced the ego depletion effect was the limited resource explanation (Baumeister et al., 1998). According to this model, self-control is a limited resource that is consumed when an individual engages in a task requiring self-control, such as the first task in the sequential task paradigm. Over time the resource becomes depleted, leaving insufficient resource for subsequent acts of self-control and thus resulting in failures on self-control tasks observed as the ego depletion effect. Baumeister et al. (1998) offered a 'strength metaphor' to illustrate how the limited resource works, and the resource depletion explanation came to be known as the 'strength' model of self-control. The model has received a great deal of attention due to its intuitive appeal and simplicity.

However, if self-control relies on a limited resource, it should have some physiological analog. As Baumeister et al. (1998) indicated in their initial experiments that it would be "implausible that ego depletion would have no physiological aspect or correlates at all" (p. 1263). Subsequent research explored the possibility that glucose was a candidate endogenous substrate for the resource, based on the premise that glucose is the primary energy source for cells, including the brain (Gailliot & Baumeister, 2007; Gailliot et al., 2007). However, initial research and subsequent meta-analyses of studies linking depletion with changes in blood glucose and glucose supplementation raised serious questions over this proposition

(Dang, 2016; Hagger & Chatzisarantis, 2013; Lange & Eggert, 2014; Vadillo, Gold, & Osman, 2016). Consistent with these analyses, Finley, Tang, and Schmeichel's (2019) high-powered experiment ($N = 371$) in the current special issue did not find any substantive association between glucose and ego depletion. In addition, the proposal of glucose as an analog for self-control resource was also questioned on several conceptual bases (Beedie & Lane, 2011; Kurzban et al., 2013). Taken together, these analyses raise questions over the viability of glucose as the physiological substrate implicated in the limited resource account of self-control.

The absence of clear evidence for a physiological analog for the limited resource, coupled with growing evidence that is difficult for the strength model to reconcile, has led researchers to propose alternative theoretical explanations. Inzlicht, Schmeichel, and McCrae (2014) proposed a self-control process model, which suggests that motivated disengagement from effortful, self-control tasks is the mechanism that underpins self-control failure. According to the model, effortful self-control is intrinsically aversive, and people are generally motivated to avoid such effort unless it clearly serves a goal-directed function. Accordingly, after a period of exerting effortful self-control, the aversive feelings accumulate, which leads people to evaluate whether the effort and aversive feelings are justified by the end goal. As the disparity between the end state and the aversive feelings increase, motivation to exert further control decreases while motivation to value and pursue alternative courses of action that bring about immediate

gratification and reduce the aversiveness increases. In this special issue, Furley, Kohlhaas, Englert, Nieuwenhuys, and Bertrams (2019) provide evidence consistent with the process model such that depletion leads to an aversive state that could be detected from nonverbal behaviors by untrained observers. Further, recent evidence also demonstrated the heightened tendency of reward seeking after exercising self-control (for a review, see Kelley, Finley, & Schmeichel, 2019). However, Giacomantonio, Jordan, and Fennis (2019) in the current special issue showed that the motivation to conserve energy and the motivation to seek rewards that both result from depletion work antagonistically, suggesting a more complex set of processes. Future research is needed to develop a more comprehensive theory that could reconcile the strength model, the process model, as well as related cognitive models of ego depletion (Dang, Björklund, et al., 2017; Dewitte, Bruyneel, & Geyskens, 2009).

Conclusion

The ego depletion effect has attracted considerable interest, most likely because it chimes well with people's everyday experiences and is relatively simple and eloquent in its predictions. While an ever-expanding body of literature has provided qualified support for the effect, there is substantial controversy over whether the effect is non-zero, and over the conceptual basis of the limited resource model proposed to explain it. Recent research, including the articles included in the current issue, has sought to

re-evaluate the methods used to test the effect, and identify and test alternative theoretical explanations for the effect. The special issue stands as an important compendium of the latest research into ego depletion, illustrates that interest and novel inquiry into the effect remains strong, and has potential to move evidence and theory on self-control failure forward.

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