Ego-depletion or mental fatigue?

Commentary: “Strong Effort Manipulations Reduce Response Caution: A Preregistered Reinvention of the Ego-Depletion Paradigm”

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- 1 Please cite as: Forestier, C., & Chalabaev, A. (2020). Ego-depletion or mental fatigue?
- 2 Commentary: “Strong Effort Manipulations Reduce Response Caution: A Preregistered
- 3 Reinvention of the Ego-Depletion Paradigm”. *SportRxiv*.
- 4 <https://doi.org/10.31236/osf.io/n3yb4>
- 5
- 6 All authors have read and approved this version of the manuscript
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9 **Abstract**

10 Ego-depletion has been one of the most criticized psychological phenomena these past years.
11 New approaches have been proposed to increase its replicability, but often failed, mostly due
12 to inaccurate conceptions that misguided methodological decisions, such as inappropriate
13 tasks choice. In this commentary, we question the *reinvention* of the ego-depletion paradigm
14 claimed by Lin et al. (2020). Specifically, we discuss the absence of a comprehensive
15 definition of self-control, which is central to the concept of ego-depletion, the lack of
16 distinction between ego-depletion and mental fatigue, and the depleting task chosen to induce
17 ego-depletion that we deem inappropriate. We propose some conceptual clarifications to
18 promote the implementation of rigorous methods in ego-depletion research.

19

Statement of relevance

20 These past years, psychology has suffered from the so-called “replication crisis”, which has
21 led to disclaim several popular psychological phenomena, such as ego-depletion. However,
22 we argue that many studies, such as the one discussed in this commentary, cannot be
23 considered as replication attempts of ego-depletion, because of inaccurate conceptions that
24 misguided methodological choices. Beyond this particular theoretical framework, this
25 commentary supports more generally the need to base research on conceptualizations that are
26 precise and that respect claims of initial theories, to increase research replicability. Indeed,
27 independently of the importance of direct and conceptual replications, and in line with recent
28 publications, this commentary proposes that the replicability of psychological research cannot
29 be optimized without first rigorously sticking to original theories’ postulates. This article
30 discusses this within the self-control phenomenon called “ego-depletion”, by commenting the
31 recent publication of Lin et al. (2020), which proposes a *reinvention* of it that does not fit the
32 original theory.

A commentary on: Strong Effort Manipulations Reduce Response Caution: A Preregistered Reinvention of the Ego-Depletion Paradigm

By Lin, H., Saunders, B., Friese, M., Evans, N., & Inzlicht, M. (2020). *Psychological Science*, 12, 35. <https://doi.org/10.1177/095679762090499>

Controlling emotions, impulses, or automatic responses that interfere with goal-directed behavior is critical for successful adaptation. A concept that has helped to better understand self-control failure is *ego depletion*, the exhaustion of capacities necessary to regulate behaviors, that results from engaging in a self-control act (Baumeister et al., 1998). This construct has been influential these past two decades before being criticized, mostly because of replicability problems. Lin et al. (2020) recently proposed to address these issues by reinventing the ego-depletion paradigm, first, by manipulating cognitive demand, and second, by observing subsequent reduction in inhibition and response caution as ego-depletion markers. Despite data quality and the sophisticated statistical analyses, this commentary points out three key issues, also common on the literature.

(1) In this article, as in others, it is crucial to define self-control, because ego-depletion originally refers to the phenomenon by which “exerting self-control in a first task led to an impaired ability to exert self-control in a second task” (Baumeister et al., 1998). Self-control has benefited from theoretical clarifications (Fujita, 2011; Gillebaart, 2018; Milyavskaya et al., 2018), in answer to years of definition’s blurring. It corresponds to self-regulation operationalization, by which an individual resolves a conflict through effortless or effortful strategies. Effortless ones (e.g., asymmetric cognitive associations, Fishbach et al., 2003) are automatic and do not require effort. Effortful ones (e.g., effortful inhibition, Muraven & Baumeister, 2000) are mostly reflective, and rely on self-control resources availability. Effortful self-control strategies draw from a resource that once emptied, reduce subsequent

58 effortful self-control strategies success (Baumeister et al., 1998; Fujita, 2011; Gillebaart,
59 2018). This temporary self-control impairment is called ego-depletion. According to these
60 definitions, (1) self-control operates only for conflict resolution, and (2) ego-depletion is the
61 phenomenon by which self-control is impaired by the use of an effortful self-control strategy
62 to resolve a conflict (e.g., originally, choosing a larger delayed reward over a smaller
63 immediate one, through inhibition; Mischel et al., 1989). However, several studies
64 investigated ego-depletion by manipulating mental/cognitive effort, with tasks unrelated to
65 self-control or to conflict resolution, resulting in null effects, or in effects that cannot be
66 defined as ego-depletion (Lurquin & Miyake, 2017). Ego-depletion controversy could have
67 been fostered by the progressive omission of the original theory this phenomenon is part of.
68 Thus, feeding this controversy with a *reinvention* of ego-depletion paradigm outside of the
69 self-control literature could harm future ego-depletion research.

70 (2) Several studies, including Lin et al. (2020), derived from the original assumption that
71 effortful self-control acts induce self-control impairment, toward the assumption that “people
72 feel tired or depleted after exerting mental effort” (Lin et al., 2020, p. 1). This claim,
73 insufficiently discriminating, postulates that any task that requires cognitive effort produces
74 ego-depletion. This differs from the original assumption (Baumeister et al., 1998; Lurquin &
75 Miyake, 2017). Similarly to criticized articles (e.g., Hagger et al., 2010), Lin et al.’s studies
76 did not distinguish ego-depletion from mental/cognitive fatigue, which is “the feeling that
77 people experience after/during prolonged periods of cognitive activity, [...] involves
78 tiredness, exhaustion, aversion to continue the present activity, a decrease in the commitment
79 level, [...] and has been associated with impaired cognitive/behavioral performance”
80 (Boksem & Tops, 2008, p. 126). Accordingly, ego-depletion may be categorized as a type of
81 mental fatigue, which results from an effortful self-control act, but does not refer to all types
82 of mental fatigue. Similarly, a decrease in cognitive performance after a demanding task

cannot systematically be interpreted as indicating ego-depletion. Within the mental fatigue literature, evidence that strong effort manipulations reduce response caution has already been found several times (e.g., Cao et al., 2016; Dimitrakopoulos et al., 2018; Marcora et al., 2009; Smolders & de Kort, 2014; Tyagi et al., 2009) and discussed in reviews (Boksem & Tops, 2008; Van Cutsem et al., 2017). Within the ego-depletion literature, the question remains open. Future studies that manipulate self-control and then observe response caution reduction could provide answers to this question. We recommend to stop using these phenomena interchangeably: although both induce a change in cognitive performance, ego-depletion occurs only when this change is induced by an effortful self-control act.

(3) Studies criticized the lack of conscientiousness during ego-depleting tasks' choice, often made "regardless of whether tasks could be considered as a valid operationalizations of self-control" (Carter et al., 2015, p. 15). Others stressed the confusion produced by "inappropriate depleting tasks" (Dang, 2018, p. 646), that do not require, or are unrelated to, self-control (Carter et al., 2015). Authors also criticized the frequent choice of tasks "mentally demanding, requiring effort, or simply being difficult", but in which we "cannot unambiguously determine whether or not it implicates self-control, and determine whether one should expect a significant ego-depletion effect" (Lurquin & Miyake, 2017, p. 2).

Accordingly, the choice of a task not related with at least one self-control strategy (i.e., symbol-counting task), and which seems distant from a conflict resolution strategy, represents a major limitation of past studies, including Lin et al. (2020). Moreover, if the exploration of ego-depletion effects on cognitive performance (e.g., response caution) justifies the choice of a subsequent task unrelated to self-control, it does not justify to choose a depleting task unrelated to self-control. We recommend more rigorous depleting task choices, by beforehand ensuring that the cognitive processes the task triggers are closely related with at least one self-control strategy. Studies could choose tasks seemingly related to self-control strategies (e.g.,

108 Go/No-Go task, Set-Switching task, Duckworth & Kern, 2011), but undetermined ones
109 should be pre-tested, to confirm their relation with a self-control strategy, and thereafter be
110 used as a validated depleting task.

111

112 In summary, in Lin et al. (2020), (1) the lack of the strict inclusion of ego-depletion within the
113 self-control literature, (2) the lack of distinction between ego-depletion and mental fatigue,
114 and (3) the inappropriate choice of the depleting task, make difficult to conclude in a
115 reinvention of the ego-depletion paradigm. This commentary aims to serve as a guidance for
116 future studies on ego-depletion and calls for the use of a rigorous methodology to test if ego-
117 depletion phenomenon truly exists.

118

119 Conflict of interest.

120 None

REFERENCES

- Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology*, 74(5), 1252–1265. <https://doi.org/10.1037/0022-3514.74.5.1252>
- Boksem, M. A. S., & Tops, M. (2008). Mental fatigue: Costs and benefits. *Brain Research Reviews*, 59(1), 125–139. <https://doi.org/10.1016/j.brainresrev.2008.07.001>
- Cao, L., Li, J., Xu, Y., Zhu, H., & Jiang, C. (2016). A hybrid vigilance monitoring study for mental fatigue and its neural activities. *Cognitive Computation*, 8(2), 228–236.
- Carter, E. C., Kofler, L. M., Forster, D. E., & Mccullough, M. E. (2015). Supplemental Material for A Series of Meta-Analytic Tests of the Depletion Effect: Self-Control Does Not Seem to Rely on a Limited Resource. *Journal of Experimental Psychology: General*, 144(3). <https://doi.org/10.1037/xge0000083.supp>
- Dang, J. (2018). An updated meta-analysis of the ego depletion effect. *Psychological Research*, 82(4), 645–651. <https://doi.org/10.1007/s00426-017-0862-x>
- Dimitrakopoulos, G. N., Kakkos, I., Dai, Z., Wang, H., Sgarbas, K., Thakor, N., Bezerianos, A., & Sun, Y. (2018). Functional connectivity analysis of mental fatigue reveals different network topological alterations between driving and vigilance tasks. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, 26(4), 740–749.
- Duckworth, A. L., & Kern, M. L. (2011). A meta-analysis of the convergent validity of self-control measures. *Journal of Research in Personality*, 45(3), 259–268. <https://doi.org/10.1016/j.jrp.2011.02.004>
- Fishbach, A., Friedman, R. S., & Kruglanski, A. W. (2003). Leading Us Not Unto Temptation: Momentary Allurements Elicit Overriding Goal Activation. *Journal of Personality and Social Psychology*, 84(2), 296–309. <https://doi.org/10.1037/0022-3514.84.2.296>

146 Fujita, K. (2011). On conceptualizing self-control as more than the effortful inhibition of
 147 impulses. *Personality and Social Psychology Review*, 15(4), 352–366.
 148 <https://doi.org/10.1177/1088868311411165>

149 Gillebaart, M. (2018). The ‘Operational’ Definition of Self-Control. *Frontiers in Psychology*,
 150 9(JUL), 1231. <https://doi.org/10.3389/fpsyg.2018.01231>

151 Hagger, M. S., Wood, C., Stiff, C., & Chatzisarantis, N. L. D. D. (2010). Ego depletion and
 152 the strength model of self-control: A meta-analysis. *Psychological Bulletin*, 136(4), 495–
 153 525. <https://doi.org/10.1037/a0019486>

154 Lin, H., Saunders, B., Friese, M., Evans, N., & Inzlicht, M. (2020). Strong Effort
 155 Manipulations Reduce Response Caution: A Preregistered Reinvention of the Ego-
 156 Depletion Paradigm. *Psychological Science*, 12, 35.
 157 <https://doi.org/10.1177/095679762090499>

158 Lurquin, J. H., & Miyake, A. (2017). Challenges to ego-depletion research go beyond the
 159 replication crisis: A need for tackling the conceptual crisis. *Frontiers in Psychology*,
 160 8(APR), 1–5. <https://doi.org/10.3389/fpsyg.2017.00568>

161 Marcora, S. M., Staiano, W., & Manning, V. (2009). Mental fatigue impairs physical
 162 performance in humans. *Journal of Applied Physiology*, 106(3), 857–864.
 163 <https://doi.org/10.1152/jappphysiol.91324.2008>

164 Milyavskaya, M., Berkman, E. T., & de Ridder, D. T. D. (2018). The many faces of self-
 165 control: Tacit assumptions and recommendations to deal with them. *Motivation Science*,
 166 0(0), xx–xx. <https://doi.org/10.1037/mot0000108>

167 Mischel, W., Shoda, Y., & Rodriguez, M. L. (1989). Delay of gratification in children.
 168 *Science*, 244(4907), 933–938. <https://doi.org/10.1126/science.2658056>

169 Muraven, M., & Baumeister, R. F. (2000). Self-Regulation and Depletion of Limited
 170 Resources: Does Self-Control Resemble a Muscle? *Psychological Bulletin*, 126(2), 247–

171 259. <https://doi.org/10.1037/0033-2909.126.2.247>

172 Smolders, K. C. H. J., & de Kort, Y. A. W. (2014). Bright light and mental fatigue: Effects on

173 alertness, vitality, performance and physiological arousal. *Journal of Environmental*

174 *Psychology*, 39, 77–91.

175 Tyagi, R., Shen, K., Shao, S., & Li, X. (2009). A novel auditory working-memory vigilance

176 task for mental fatigue assessment. *Safety Science*, 47(7), 967–972.

177 Van Cutsem, J., Marcora, S., De Pauw, K., Bailey, S., Meeusen, R., & Roelands, B. (2017).

178 The Effects of Mental Fatigue on Physical Performance: A Systematic Review. *Sports*

179 *Medicine*, 47(8), 1569–1588. <https://doi.org/10.1007/s40279-016-0672-0>

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