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**Implicit Theories About Willpower Predict the Activation of a Rest Goal Following Self-
Control Exertion**

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Abstract

Past research indicates that peoples' implicit theories about the nature of willpower moderate the ego depletion effect. Only people who believe or were led to believe that willpower is a limited resource (limited-resource theory) showed lower self-control performance after an initial demanding task. As of yet, the underlying processes explaining this moderating effect by theories about willpower remain unknown. Here, we propose that the exertion of self-control activates the goal to preserve and replenish mental resources (rest goal) in people with a limited-resource theory. Five studies test this hypothesis. In Study 1, individual differences in implicit theories about willpower predicted increased accessibility of a rest goal after self-control exertion. Furthermore, measured (Study 2) and manipulated (Study 3) willpower theories predicted an increased preference for rest-conducive objects. Finally, Studies 4 and 5 provide evidence that theories about willpower predict actual resting behavior: In Study 4, participants who held a limited-resource theory took a longer break following self-control exertion than participants with a nonlimited-resource theory. Longer resting time predicted decreased rest goal accessibility afterwards. In Study 5, participants with an induced limited-resource theory sat longer on chairs in an ostensible product-testing task when they had engaged in a task requiring self-control beforehand. This research provides consistent support for a motivational shift toward rest after ego depletion in people holding a limited theory about willpower.

Keywords: implicit theories, willpower, self-control, ego depletion, rest goal

Implicit Theories About Willpower Predict the Activation of a Rest Goal Following Self-Control Exertion

People endorse different beliefs— implicit theories— about the nature of willpower and these beliefs affect their self-control and achievement outcomes in everyday life (Job, Walton, Bernecker, & Dweck, in press). When people believe that willpower is a limited resource (*limited-resource theory*), as the strength model of self-control suggests (Baumeister, Vohs, & Tice, 2007), they show the so-called *ego depletion effect*. They exhibit lower self-control performance on a demanding task following previous self-control exertion – their performance mirrors their belief. In contrast, people who believe that willpower is not a limited resource (*nonlimited-resource theory*) are better able to maintain their self-control performance at high levels (Job, Dweck, & Walton, 2010; Miller et al., 2012; see also Salmon, Adriaanse, DeVet, Fennis, & DeRidder, 2014). Studies found similar effects on self-control performance when implicit theories about willpower were not measured, but were experimentally manipulated, showing the causal effect of these theories (Job et al., 2010). Moreover, recent research indicates that a limited-resource theory is dysfunctional in students' everyday lives. When students with a limited-resource theory face high demands, their self-regulation is impaired and they earn lower grades as compared to students with a nonlimited-resource theory about willpower (Job et al., in press). Taken together, these findings suggest that a limited-resource theory leads people to act as though their self-regulatory resources are depleted before they reach the true limit of their self-regulatory capacity and this can have far-reaching consequences.

What processes account for the differences in self-regulation between people holding a limited versus a nonlimited theory about willpower? So far, the answer to this question remains unknown. The process model of self-control, a recent theoretical alternative to the strength model of self-control, suggests that ego depletion effects are caused by shifts in motivation and attention (Inzlicht & Schmeichel, 2012; Inzlicht, Schmeichel, & Macrae, 2014). It proposes that after they exerted self-control people are no longer motivated to exert themselves further and therefore

perform worse on subsequent self-control tasks. Akin to this theorizing, we propose that the effect of implicit theories about willpower on self-control performance can be explained by a change in the motivational orientation, triggered by the initial exertion of self-control. We postulate that specifically for people with a limited-resource theory, as compared to people with a nonlimited-resource theory, exerting self-control activates the goal to preserve and replenish mental resources (*rest goal*), which translates into actual resting behavior. The aim of the present research was to document differences in rest goal activation and rest behavior following self-control exertion depending on peoples' implicit theory about willpower.

Preservation of Resources

Previous research speaks to the idea that people strategically preserve resources, particularly after they had to control themselves, and when they expect further self-control demands in the near future (Muraven, Shmueli, & Burkley, 2006). In a series of experiments, Muraven and colleagues (2006) showed that participants who had engaged in an initial self-control task performed more poorly on a second task when they were told that there would be a third task requiring self-control awaiting than when they did not expect a third self-control task. Similarly, Tyler and Burns (2009) showed that participants who had exerted self-control performed worse when they thought they would have to complete further tasks than when they thought they were approaching the end of the study. These results provided initial evidence that motivation to preserve mental resources may be involved in the ego depletion effect.

The present research links the conserving strength hypothesis with the implicit theories about willpower approach. We argue that only people with a limited-resource theory will exhibit increased orientation towards the goal of preserving their resources after they engage in a self-control task. As outlined above, previous research documents that only people with a limited-resource theory perform worse after initial self-control exertion (Job et al., 2010). These findings are compatible with the notion that people with a limited-resource theory have the goal to preserve resources, but as yet empirical evidence for this idea is lacking. The present research was

conducted to test this assumption by measuring indicators of rest goal activation and rest behavior. We expected both rest goal activation and rest behavior to be high in people with a limited resource theory after self-control exertion.

Goals for Action versus Inaction

Recent research documents that the general goal to be active, as compared to the general goal to be inactive, guides a vast array of behavior including effort and performance on cognitive tasks (Albarracín, Hepler, & Tannenbaum, 2011). Action versus inaction goals are defined as the “motivational end states that regulate the pursuit of high-effort, active behavior versus low-effort, inactive behavior, regardless of the specific behavior in question” (Albarracín et al., 2011, p. 119). Accordingly, if people strive for inaction goals (doing nothing), this affects their level of activity and effort they invest in other goals and tasks at hand. In a series of experiments, Albarracín and colleagues (2008) showed that priming participants with action versus inaction concepts by presenting words like ‘go’ and ‘move’ versus ‘calm’ and ‘relax’, thereby increasing the accessibility of these concepts, affected whether they chose an active versus inactive task. That means the action and inaction priming affected people’s choice for an activity that would serve their goal. It further affected their cognitive performance. Participants who were primed with ‘inaction’ recalled less of a previously read passage and they solved fewer SAT-like problems as compared to participants who were primed with ‘action’.

We suggest that participants with a limited-resource theory will, like participants who were primed with the concept of inaction in the work by Albarracín and colleagues, strive for rest and relaxation, which implies inaction. That means after they have engaged in a task requiring self-control, people with a limited-resource theory should not only show increased cognitive accessibility of rest-related concepts, but also choose to be inactive, when given the opportunity.

The Present Research

This research was conducted to test the hypothesis that in people with a limited-resource theory, engaging in self-control activates a rest goal – the goal to preserve and replenish the

precious strength that they have just spent. We used indirect implicit and behavioral indicators of such a motivational shift because of peoples' well-documented limited introspective abilities that often lead to invalid self-reports about inner motivational states (e.g., Silvia & Gendolla, 2001; Wilson & Dunn, 2004). Moreover, even if participants were able to correctly perceive their motivational inclination they might not always be willing to share them. In particular, participants may be reluctant to convey to the experimenter that they feel like resting and relaxing in a research study that they get paid for. Therefore, we relied on procedures to assess manifestations of rest goal activation based on reaction times, object evaluations, and actual resting behavior.

Previous research indicates that active, unfulfilled goals enhance the accessibility of goal-related concepts (e.g., Aarts & Dijksterhuis, 2003; Förster, Liberman, & Higgins, 2005). For example, Förster and colleagues (2005) showed that participants who had the goal to find a specific target stimulus showed enhanced accessibility of target-related words prior to finding the target and reduced accessibility after finding it. Therefore, an active rest goal should manifest as higher accessibility of rest-related concepts in the semantic network. Study 1 was designed to test the hypothesis that theories about willpower predict the accessibility of a rest goal following self-control exertion. Accessibility of a rest goal was measured using a lexical decision task (Meyer & Schvaneveldt, 1971), one of the most widely used tasks to measure cognitive accessibility in the semantic network (Higgins, 1996). We expected that people with a limited-resource theory about willpower would be faster in recognizing rest-related words as words in the lexical decision task after they had engaged in an initial task requiring self-control.

Research further shows that activated goals affect how people evaluate objects. Specifically, objects that are means to a current goal are evaluated more positively (Ferguson & Bargh, 2004; Fishbach, Shah, & Kruglanski, 2004). Studies 2 and 3 built on this phenomenon to provide further support for the rest goal hypothesis. The studies tested whether people with a limited-resource theory would more strongly value means to reach the goal to rest and recover after they exerted self-control. We assumed that participants with a limited-resource theory (measured in Study 2 and

manipulated in Study 3) would evaluate rest-conducive objects more positively when they were depleted by initial self-control exertion than when they were not depleted.

Finally, an activated rest goal should translate into actual resting behavior. Therefore, Studies 4 and 5 were dedicated to the question of whether participants with a limited-resource theory would engage in more actual resting behavior after depletion. Study 4 had a correlational design, testing whether theories about willpower predicted the length of a break participants took after an initial depleting task and in turn affect remaining rest goal accessibility. In Study 5, both theories about willpower and depletion were manipulated. We unobtrusively assessed how long participants sat on a variety of chairs in an ostensible product-testing task.

Study 1

Study 1 investigated whether individual differences in implicit theories about willpower predict activation of a rest goal assessed with a lexical decision task after self-control exertion. Implicit theories about willpower were measured with a questionnaire used by Job and colleagues (2010) and self-control exertion was manipulated with a thought suppression task (Wegner, Schneider, Carter, & White, 1987). We expected that in depleted participants with a limited theory about willpower, rest-related concepts will be highly accessible in the semantic network as indicated by faster reaction times to rest-related words in a lexical decision task (Meyer & Schvaneveldt, 1971).

Method

Participants. Participants ($N = 93$) were recruited at a university participant pool and via online advertisements to participate in a study on “cognitive and verbal competencies” in exchange for 15 Swiss francs (i.e., \$16 USD). The majority of the participants (92.5%) were university students enrolled in different faculties. They were run in individual sessions. Data from two participants were excluded; one did not speak German and the other was a distinct outlier on the error rate. The cutoff criterion was defined at a 25% error rate. The excluded participant made 77% errors (23 out of 30) on the critical rest-word trials of the lexical decision task, indicating that he did

not follow the instructions. The final sample ($N = 91$) contained 71 females and 20 males ($M_{age} = 22.91$, $SD = 2.81$).

Procedure. First, participants provided informed consent, reported demographic information (age, gender, major, German proficiency), and completed several scales about personal beliefs including theories of intelligence (Dweck, 1999), emotion (Tamir, John, Srivastava, & Gross, 2007), resisting temptation, and physical activity (self-created). Embedded among these was a German translation of the Implicit Theories About Willpower Scale (6 items; Job et al., 2010). Example items are “After a strenuous mental activity your energy is depleted and you must rest to get it refueled again” (limited-resource theory) and “Your mental stamina fuels itself; even after strenuous mental exertion you can continue doing more of it” (nonlimited-resource theory) ($1 = strongly\ agree$, $6 = strongly\ disagree$). Items referring to the limited-resource theory were reverse-scored so that higher values represent greater agreement with the limited-resource theory ($\alpha = .85$, $M = 3.81$, $SD = 0.78$). The same scale was repeatedly used in previous research in which its high internal consistency and predictive validity were documented (Job et al., 2010, 2013, in press). Furthermore, a longitudinal study documented the middle-term stability of the Implicit Theories About Willpower Scale ($r = .77$) over two months (Job et al., 2010, Study 4).

Next, ego depletion was manipulated by assigning participants randomly to either a thought suppression condition (high depletion) or a low depletion control condition (Muraven, Tice, & Baumeister, 1998). Participants in the thought suppression condition were asked to write down all their thoughts on a piece of paper without thinking of a white bear (Wegner et al., 1987). Every time they thought of a white bear they were asked to make a mark on the margin of the paper. Participants in the low depletion condition were instructed to think of whatever they want and note their thoughts on a piece of paper. The task lasted 10 minutes.

Next, as a manipulation check, participants rated on a 7-point scale ($1 = not\ at\ all$, $7 = very\ much$) “How much did you have to control yourself to complete the task as instructed?”, “How exhausting was the task?”, and “How much did you have to concentrate to complete the task as

instructed?” ($\alpha = .84$).

Finally, participants completed a lexical decision task assessing the accessibility of rest-related words as an indicator of the activation of a rest goal (Förster et al., 2005). A series of letter strings was presented in the center of the screen and participants were asked to decide as quickly as possible whether a letter string was a real word. Each trial started with the presentation of a fixation cross (+ sign) for 500 ms followed by the letter string, which remained on the screen until participants either pressed the *S* key for nonwords or the *L* key for words. If they provided the wrong answer a red *X* appeared for 1 s. The inter-trial-interval was 500 ms until the subsequent fixation cross appeared. We created a set of 15 rest-related words (e.g., the German words for rest, vacation, break, relax, sleep) and 15 neutral words (e.g., German words for paper, normal, tablet, pen, lamp, door) to use as stimuli. The full list with the original German words and their English translation is available in Table S1 in the online supplement. In an online pilot study ($N = 81$), participants rated the words with respect to the following statement: “How much do you associate this word with rest and relaxation?” Participants answered on a 7-point scale ranging from -3 (not at all) to +3 (completely). A paired-sample *t*-test confirmed that the rest-related words were significantly more related to rest ($M = 6.34$, $SD = 0.47$) than the control words ($M = 2.35$, $SD = 0.85$), $t(80) = 38.28$, $p < .001$. Further, 30 nonwords – letter strings that had no semantic meaning – of equal length as the words were created. The nonwords were pronounceable and contained a mix of consonants and vowels with the appearance of real German words. Each word and nonword was presented twice for a total of 120 trials.

Results

Manipulation Check

We conducted a regression analysis to see whether the depletion manipulation was successful and whether the experience of the task as depleting was moderated by theories about willpower. The depletion condition (0 = low depletion, 1 = high depletion), standardized theories about willpower, and their interaction were entered as predictors. As expected, there was a

significant main effect for the depletion condition, $\beta = .60$, $b = 2.03$, $SE = .29$, $t(87) = 7.07$, $p < .001$, 95% CI [1.46, 2.60], indicating that the manipulation was successful. Participants in the thought suppression condition experienced the task as more demanding and depleting than participants in the free thought condition. Neither the main effect of theories about willpower nor the interaction with the depletion condition was significant, $t_s(87) < 1$. This result indicates that theories about willpower did not affect whether participants experienced the task as depleting, replicating previous findings (Job et al., 2010).

Accessibility of the rest goal

Reaction times in the lexical decision task were cleaned for outliers by removing times shorter than 300 ms and longer than three standard deviations from the sample mean. Only reaction times of correct response trials were included in the analysis. Together, this resulted in the exclusion of 6.65% of reaction times. Mean reaction times for rest words and neutral words were calculated and because they were skewed they were ln-transformed for further analyses.

To test whether theories about willpower interacted with depletion in predicting rest goal accessibility we conducted a hierarchical regression analysis of reaction times to rest words controlling for reaction times to neutral words in the first step, $\beta = .82$, $b = .11$, $SE = .01$, $t(88) = 15.13$, $p < .001$, 95% CI [0.09, 0.13]. Further, participants' proficiency in the German language was included as a control variable since it was significantly related to response latencies, $\beta = .15$, $b = .05$, $SE = .02$, $t(88) = 2.84$, $p = .006$, 95% CI [0.01, 0.09].

Depletion condition (0 = low depletion, 1 = high depletion) and implicit theories about willpower (centered) were entered in the second step of the regression. Neither the effect of depletion condition, $\beta = -.05$, $b = -.01$, $SE = .01$, $t(85) = -.97$, $p = .335$, 95% CI [-0.04, 0.01], nor theories about willpower, $\beta = .12$, $b = .02$, $SE = .01$, $t(85) = 1.63$, $p = .107$, 95% CI [0.00, 0.03], reached significance. Most importantly, as predicted, there was a significant interaction between theories about willpower and depletion conditions, $\beta = -.20$, $b = -.03$, $SE = .01$, $\Delta R^2 = 0.02$, $t(85) = -2.66$, $p = .009$, 95% CI [-0.06, -0.01] (Figure 1). Simple-slope analyses showed that within the high

depletion condition, theories about willpower were significantly related to rest word reaction times, $b = -.02$, $SE = .01$, $t(85) = -2.10$, $p = .039$, 95% CI [0.00, -0.04]. The more participants endorsed a limited-resource theory, the faster they were in recognizing rest words as words, suggesting higher accessibility. In the low depletion condition, there was a non-significant trend in the opposite direction, $b = .02$, $SE = .01$, $t(85) = 1.67$, $p = .099$, 95% CI [0.00, 0.04]. Further, there was a significant effect of depletion condition for participants with a limited-resource theory (+1 *SD*), $b = -.05$, $SE = .02$, $t(85) = -2.51$, $p = .014$, 95% CI [-0.09, -0.01]. When they were depleted they were faster in recognizing rest words than when they were not depleted. Participants with a nonlimited-resource theory (-1 *SD*) showed no difference between the depletion conditions, $b = .02$, $SE = .02$, $t(85) = 1.19$, $p = .237$, 95% CI [-0.02, 0.06].

Discussion

The results provide evidence for the hypothesis that for people with a limited theory about willpower exercising self-control makes the goal to rest more accessible. In the depletion condition, the more participants endorsed a limited-resource theory the faster they were in recognizing rest-related words as words. Hence, while previous research documents that individuals with a limited resource theory show impaired performance on self-control tasks following self-control exertion (Job et al., 2010), their performance regarding rest words was better (i.e. shorter reaction times) after self-control exertion in this study. The findings are consistent with the assumption that active, unfulfilled goals enhance the accessibility of goal-related concepts (Förster et al., 2005).

Study 2

Study 1 provides first evidence that a limited theory about willpower predicts the activation of a rest goal after self-control exertion, indicated by enhanced accessibility of rest-related concepts. In Study 2, we sought to conceptually replicate this finding with a different indicator of goal activation: evaluation of goal-conducive objects (Fishbach et al., 2004).

Again, theories about willpower were measured. Participants then completed either a task requiring high or low self-control and rated a series of objects, which were neutral, rest-conducive,

or exertion-conducive. We expected that theories about willpower would predict the evaluation of rest-conducive and exertion-conducive objects depending on previously exerted self-control.

Method

Participants. Participants ($N = 68$; 53 females; $M_{age} = 24.19$, $SD = 3.39$) were recruited through both a university participant pool and online advertisements seeking participation in a study on task and product evaluations in exchange for 20 Swiss francs (i.e., \$22 USD). Most participants (83.8%) were students enrolled in different fields of study. They were run in individual sessions.

Materials and procedure. First, participants provided informed consent, reported demographic information, and completed the same set of scales as in Study 1. Again, one of these scales measured implicit theories about willpower ($\alpha = .86$, $M = 3.93$, $SD = 0.87$). Next, depletion was manipulated by the same thought suppression task as in Study 1, followed by the three manipulation check items ($\alpha = .81$)¹.

As the dependent measure, participants saw 17 pictures of various objects and furniture². Six pictures depicted objects that are helpful for getting rest (bed, sofa, hammock, cup of tea, bathtub, TV-screen) and six pictures depicted objects that are used for physical or mental exertion (barbell, racing bicycle, punching bag, treadmill, sneakers, Sudoku puzzles). The other 5 control pictures contained objects, which implied mild forms of physical and mental activity; they were moderately conducive for rest and/or required moderate levels of effort (e.g., hand training balls, personal computer, cookies, electric iron, headphone). For each object participants were asked to answer the question “How much do you like this object?” on a 7-point scale (1 = *not at all*, 7 = *very much*). Mean ratings of rest-conducive ($\alpha = .41$), exertion-conducive ($\alpha = .61$), and control objects ($\alpha = .57$) were computed. Reliabilities were low. This might be a result of the high heterogeneity of objects within the respective categories (see above).

In a pilot study participants from the same population of participants as in the main study ($N = 27$) rated the objects with respect to two statements: “With the help of this object I can rest and recover” and “Handling this object requires a lot of effort”. Participants answered on a 7-point scale

ranging from 0 (*not at all true*) to 6 (*very true*). Repeated-measures ANOVAs of mean ratings confirmed that the three object categories varied significantly regarding perceived helpfulness for rest, $F(2, 52) = 100.49, p < .001, \eta^2 = .79, 95\% \text{ CI } [.63, .82]$, and required effort, $F(2, 52) = 311.87, p < .001, \eta^2 = .92, 95\% \text{ CI } [.85, .93]$. Rest-conductive objects were rated as highly helpful for rest and recovery ($M = 5.94, SD = 0.70$) and exertion-conductive objects ($M = 2.67, SD = 1.04$) as least helpful for rest. Control objects were perceived as moderately helpful for rest ($M = 4.07, SD = 1.10$). Tests of within-subjects contrasts show that control objects differed significantly from rest-conductive objects, $F(1, 26) = 151.63, p < .001, \eta^2 = .85, 95\% \text{ CI } [.72, .90]$, and exertion-conductive objects, $F(1, 26) = 28.06, p < .001, \eta^2 = .52, 95\% \text{ CI } [.22, .68]$. The opposite was the case for effort ratings: exertion-conductive objects were rated as requiring most effort ($M = 4.70, SD = 0.74$) and rest-conductive objects as requiring least effort ($M = 1.46, SD = 0.41$). Again, effort-ratings for control objects were in the middle ($M = 2.50, SD = 0.64$) differing significantly from the ratings of rest-conductive objects, $F(1, 26) = 81.71, p < .001, \eta^2 = .76, 95\% \text{ CI } [.55, .84]$, and exertion-conductive objects, $F(1, 26) = 129.95, p < .001, \eta^2 = .92, 95\% \text{ CI } [.68, .89]$.

Results

Manipulation Check

We conducted a regression analysis of the manipulation check to see whether the depletion manipulation was successful and whether it was moderated by theories about willpower. The depletion condition (0 = low depletion, 1 = high depletion), standardized theories about willpower, and their interaction were entered as predictors in the regression equation. As expected, there was a significant main effect for the depletion condition, $b = .81, SE = .35, t(64) = 2.30, p = .025, 95\% \text{ CI } [0.11, 1.51]$, indicating that the manipulation was successful. Participants in the thought suppression condition experienced the task as more demanding and depleting. As in Study 1, neither the main effect of theories about willpower nor the interaction with the depletion condition was significant, $t_s(64) < 1$.

Evaluation of rest-conductive objects

We hypothesized that depletion would cause participants with a limited theory about willpower to evaluate objects conducive to rest more positively. To test this hypothesis, we conducted a hierarchical regression analysis of evaluations of rest-conducive objects controlling for general response tendencies by including evaluations of control objects in the first block. Depletion condition (0 = low depletion, 1 = high depletion) and implicit theories about willpower (standardized) were entered in the second block, followed by their interaction term in the third block.

The first block, containing evaluation of control objects was significant, $\beta = .59$, $b = .45$, $SE = .08$, $R^2 = .35$, $t(66) = 5.91$, $p < .001$, 95% CI [0.29, 0.61]. In the second block, neither the effect of depletion condition, $\beta = .10$, $b = .15$, $SE = .15$, $t(64) = 0.95$, $p = .345$, 95% CI [-0.16, 0.45], nor the effect of implicit theories about willpower was significant, $\beta = .09$, $b = .07$, $SE = .08$, $t(64) = 0.85$, $p = .399$, [-0.09, 0.22]. Their interaction, however, was significant, $\beta = .31$, $b = .39$, $SE = .15$, $\Delta R^2 = .06$, $t(63) = 2.57$, $p = .012$, 95% CI [0.09, 0.70]. Figure 2a displays predicted values for the mean evaluation of rest-conducive objects as a function of depletion condition and willpower theory. Simple-slope analyses showed that within the depletion condition there was a significant effect of willpower theories, $b = .31$, $SE = .12$, $t(63) = 2.63$, $p = .011$, 95% CI [0.07, 0.55]. After being depleted, the more participants endorsed a limited theory about willpower the more positively they evaluated rest-conducive objects. There was no effect of theories about willpower in the low depletion condition, $b = -.08$, $SE = .09$, $t(63) = -.85$, $p = .398$, 95% CI [-0.26, 0.10]. Further, participants with a limited-resource theory (+1 *SD*) evaluated rest-conducive objects more positively when they were in the high depletion condition as compared to the low depletion condition, $b = .53$, $SE = .21$, $t(63) = 2.51$, $p = .015$, 95% CI [0.29, 0.61]. Participants with a nonlimited-resource theory (-1 *SD*) showed no difference between the depletion conditions, $b = -.26$, $SE = .21$, $t(63) = -1.21$, $p = .232$, 95% CI [-0.67, 0.15].

Evaluation of exertion-conducive objects

Next, we ran the same analysis predicting evaluations of exertion-conducive objects. After

controlling for evaluations of control objects in the first block, $\beta = .17$, $b = .17$, $SE = .12$, $R^2 = .03$, $t(66) = 1.44$, $p = .155$, 95% CI [-0.07, 0.41], implicit theories about willpower, $\beta = -.15$, $b = -.15$, $SE = .12$, $t(64) = -1.23$, $p = .222$, 95% CI [-0.39, 0.09], and depletion conditions, $\beta = -.02$, $b = -.04$, $SE = .24$, $t(64) = -0.17$, $p = .867$, 95% CI [-0.51, 0.43], were entered in the second block. The interaction followed in the third block and was significant, $\beta = -.32$, $b = -.52$, $SE = .24$, $\Delta R^2 = 0.06$, $t(63) = -2.12$, $p = .038$, 95% CI [-0.99, -0.05], revealing the opposite pattern than obtained for rest-conductive objects (Figure 2b). Within the depletion condition, theories about willpower were related to object evaluations. The more participants endorsed a limited-resource theory the more negative was their evaluation of exertion-conductive objects, $b = -.48$, $SE = .19$, $t(63) = -2.46$, $p = .016$, 95% CI [-0.85, -0.11]. There was no effect of theories within the non-depletion condition, $b = .04$, $SE = .15$, $t(63) = 0.28$, $p = .784$, 95% CI [-0.25, 0.33]. Further, there was a non-significant trend for participants with a limited-resource theory (+1 *SD*) to evaluate exertion-conductive objects more negatively when they were depleted as compared to the low depletion condition, $b = -.55$, $SE = .33$, $t(63) = -1.64$, $p = .107$, 95% CI [-1.20, 0.10]. For participants with a nonlimited theory (-1 *SD*) the effect of depletion condition was non-significant, $b = .49$, $SE = .34$, $t(63) = 1.43$, $p = .157$, 95% CI [-0.18, 1.16].

Discussion

Study 2 provides further evidence for the assumption that following the exertion of self-control, individual differences in implicit theories about willpower predict the activation of a rest goal as indicated by the evaluation of rest-conductive objects. In the high depletion condition, endorsement of a limited-resource theory was associated with more positive evaluations of rest-conductive objects. Further, participants with a limited-resource theory devaluated objects conducive to physical and mental exertion. This result indicates that after self-control exertion a limited theory about willpower may affect motivational orientation in both directions: that is, people are inclined to value rest and recovery and devalue activities of high effort and exertion.

Study 3

The aim of Study 3 was to confirm the proposed causal direction of the effect of implicit theories about willpower. Therefore, theories about willpower were manipulated. We tested whether an induced limited (vs. nonlimited) theory about willpower would lead to a more positive evaluation of rest-conducive objects after self-control exertion (vs. a control task not requiring self-control). Further, we aimed to improve the set of picture cues used for the object evaluations. In Study 2, the set of objects was highly heterogeneous covering a wide range of objects and colors. Participants' general evaluations of these objects might have played an important role in their specific object evaluations, which was evident in the low internal consistency of the object ratings. Therefore, we decided to use a more homogenous set of objects in Study 3: different kinds of white furniture.

Method

Participants and procedure. Two-hundred and twenty hits were posted on U.S. Amazon Mechanical Turk to recruit U.S. residents to participate in a 20 min online study paying \$2 USD. Passing a diligence test was required for participation. Concretely, participants who failed to follow the instruction to write the word “reader” as an answer to three open ended questions (e.g., “On average, how many times a day do you think about getting something you want?”) were piped to the end of the study. Based on their Mechanical Turk ID, 18 participants were excluded who had participated in an unrelated study with the same depletion manipulation before. Two participants were excluded because they did not follow the instructions in the depletion condition. In addition nine participants were excluded based on the suspiciousness check (see below). The final sample consists of 191 participants (106 females; $M_{age} = 34.72$, $SD = 10.44$).

Participants were randomly assigned to the experimental conditions in a 2 (theory about willpower: limited vs. nonlimited) \times 2 (depletion: low vs. high) design. First, theories about willpower were manipulated with a procedure validated in past research (Job et al., 2010; Job et al., 2013; Vohs, Baumeister, & Schmeichel, 2013). Participants completed a biased 7-item questionnaire. Items were formulated to foster agreement with either a limited-resource theory (e.g.,

“Working on a strenuous mental task can make you feel tired such that you need a break before accomplishing a new task”) or a nonlimited-resource theory (e.g., “Sometimes, working on a strenuous mental task can make you feel energized for further challenging activities”) (1 = *strongly agree*, 6 = *strongly disagree*). One-sample *t*-tests comparing the mean in each condition to the scale midpoint (3.50) indicated that participants agreed with the suggested theory in both the limited theory condition ($M_{diff} = -1.12$, 95% CI [-1.32, -0.91]), $t(94) = -10.78$, $p < .001$, and the nonlimited theory condition ($M_{diff} = -1.02$, 95% CI [-1.23, -0.81]), $t(96) = -9.63$, $p < .001$. Several studies conducted by different laboratories employing participants from various countries deliver evidence for the validity of this manipulation (Job et al., 2010; Job et al., 2013; Vohs et al., 2013).

Next, participants were assigned to one of two versions of a typing task, which either required low (low depletion condition) or high (high depletion condition) self-control. The procedure was adopted from vanDellen, Shea, Davisson, Koval, and Fitzsimons (2014), who successfully manipulated depletion in an online study. Participants in the low depletion condition retyped two paragraphs, which were presented as an image file above a text box in order to prevent them from copy-pasting the text. Participants in the high depletion condition only retyped the first paragraph. For the second paragraph they were asked to retype it without using the space bar and the letter ‘e’. This more complex latter task requires self-control because participants have to constantly override the tendencies to press the often used space bar and e-key.

Following the typing task participants answered the following manipulation check questions on a 7-point scale (1 = *not at all*, 7 = *very much*): “How difficult was the task?”, “How exhausting was the task?”, and “How much did you have to concentrate during the task?” ($\alpha = .77$).

Next, participants completed the object-evaluation task. They saw 15 pictures depicting white furniture. Five pieces were conducive to rest (couch, 2 armchairs, divan bed, hammock) and the others were neutral (2 lamps, 2 tables, 2 wardrobes, 2 commodes, coat hook, side table). As in Study 2, participants were asked to indicate for each object how much they liked it on a 7-point scale (1 = *not at all*, 7 = *very much*). Mean ratings were computed for rest-conducive ($\alpha = .69$) and

neutral objects ($\alpha = .75$).

Finally, participants rated each object once more with respect to the statement “With the help of this object I can rest and recover”. They provided their answer on a 6-point scale ranging from 1 (*not at all true*) to 6 (*very true*). A paired samples *t*-test confirmed that the two object categories varied significantly regarding the association with rest, $t(190) = 47.97, p < .001$. Rest-conducive objects were rated as significantly more conducive for rest and recovery ($M = 5.23, SD = 0.60$) than neutral objects ($M = 1.52, SD = 0.80$). The mean difference was 3.71, 95% CI [3.61, 3.90].

Once participants reached the end of the study they were asked to write in a text box what they thought this study was about. Their answers were coded for suspiciousness regarding the research question. Participants who correctly guessed that we were interested in the idea that doing something tiring may lead people to like rest-related furniture more were excluded from the analyses ($n = 9$).

Results

Manipulation check

A depletion (high vs. low) \times theory (limited vs. nonlimited) analysis of variance (ANOVA) of the manipulation check yielded a significant main effect of depletion, $F(1, 187) = 42.89, p < .001, \eta^2 = .19, 95\% \text{ CI } [.09, .28]$. Participants in the high depletion condition experienced the task as more difficult and demanding as compared to participants in the low depletion condition. Neither theories about willpower nor the interaction were significant, $F < 1$.

Evaluation of objects

We conducted a 2 (depletion: high vs. low) \times 2 (willpower theories: nonlimited vs. limited) between-subjects ANCOVA on the mean ratings of rest-conducive objects, with mean ratings of control objects as covariates, to control for participants' overall evaluation tendencies. The results support the predicted interaction between depletion condition and induced willpower theory, $F(1, 186) = 4.48, p = .036, \eta^2 = .02, 95\% \text{ CI } [.00, .08]$ (Figure 3).

Simple-effects analyses revealed that, as expected, in the limited theory condition participants evaluated rest-conducive objects more positively when they were depleted than when they were not depleted, $F(1, 186) = 6.58, p = .011, \eta^2 = .03, 95\% \text{ CI } [.002, .10]$. In the nonlimited theory condition there was no difference between participants who were depleted and those who were not depleted, $F < 1$. Further, among participants who were depleted, those who were led to believe that willpower is a limited resource tended to value rest-conducive objects more as compared to those in the nonlimited theory condition, $F(1, 186) = 3.69, p = .056, \eta^2 = .02, 95\% \text{ CI } [.00, .07]$.

Discussion

The results of Study 3 provide further evidence for the hypothesis that theories about willpower predict the activation of a rest goal after previous self-control exertion. Participants who were led to adopt a limited-resource theory evaluated objects conducive to rest more positively when they were depleted than when they were not depleted. Together with the first two studies, these results support our rest goal hypothesis, adding evidence for the suggested causal effect of implicit theories about willpower on rest goal activation after depletion.

Study 4

The aims of Study 4 were twofold. First, we tested whether the motivation to rest after self-control exertion of participants with a limited-resource theory would translate into actual rest behavior. All participants of this study had participated in another, unrelated study during which they completed a depleting working memory task for 20 minutes. Engaging in working memory tasks and solving other complex arithmetic problems reliably leads to ego depletion effects (Hagger, Wood, Stiff, & Chatzisarantis, 2010; Schmeichel, 2007). We made use of this situation and gave participants the opportunity to take a break for as long as they wanted before continuing with the next study. We expected that implicit theories about willpower would predict the length of the break with a limited-resource theory being associated with a longer break.

Second, Study 4 tested the effect of resting on successive rest goal accessibility. Previous

research shows that goal fulfillment inhibits the accessibility of goal-related concepts (Förster et al., 2005; Marsh, Hicks, & Bryan, 1999; Zeigarnik, 1927). Accordingly, we assumed that fulfilling the rest goal by taking a break would result in reduced rest goal accessibility. Therefore, participants completed the lexical decision task from Study 1 after the break. We expected that the length of the break would be negatively related to the accessibility of rest-related concepts.

Method

Participants. Fifty students (41 females; $M_{age} = 24.06$, $SD = 3.88$) were recruited to participate in two separate studies in exchange for 20 Swiss francs (i.e., \$22 USD). They were recruited with flyers distributed on campus, with online advertisements on sales forums for students, and via mailing lists.

Procedure. As soon as participants signed up for the studies they were emailed a link to an online questionnaire. The questionnaire contained, among others³, the long version of the Implicit Theories about Willpower Scale, assessing willpower theories with 12 items ($\alpha = .82$, Job et al., 2010). About one week later, participants took part in individual lab sessions and filled in two separate consent forms, one for each study. Then they completed an experimental manipulation, which was part of an unrelated study and concerned participants' expectations about performance on the following task⁴. Participants then worked on a 20-minute n-back task (2 blocks 2-back and one block 3-back; Jaeggi, Buschkuhl, Perrig, & Meier, 2010). This task is commonly used to measure working memory capacity. It requires participants to constantly update their working memory in order to correctly recall locations of objects on the screen. Performance in this task served as the dependent measure in the unrelated study. Importantly for present purposes, working memory capacity tasks are strenuous mental tasks that require self-control and lead to ego depletion effects (Schmeichel, 2007). Therefore, participants were highly depleted at the end of this study.

Immediately after participants had finished the N-Back Task the experimenter guided them to another lab room to participate in the second study. He asked them to take a seat in a comfortable armchair that was located in front of a small table filled with magazines. Once they sat, he told them

that the second study involved a set of tasks to be solved that would take no longer than 10 minutes to complete. Further he emphasized that he would only return to the lab room in 20 minutes, because he had to run the next participant of the first study. With this instruction we aimed to fix the time participants expected to spend in the lab room but at the same time leave them free to choose how long of a break they would take before they continued with the next task. Finally, the experimenter told the participants to “take a break for as long as you need”. Before he left the room he set up the lexical decision task as described in Study 1 on the computer and thereby also set a hidden timer that measured the time until the participant started. Immediately after he had set the timer the experimenter left the room and returned after 20 minutes to compensate, debrief, and thank participants. One experimenter ran all participants. He was trained to keep the duration of the instructions constant and was blind regarding participants’ scores on the Implicit Theories about Willpower Scale.

Results

Theories about willpower and length of the break

One participant was removed from the analyses since she was a distinct outlier taking a break longer than three standard deviations from the mean. On average, the other participants took a break of one minute ($M = 59.56$ sec, $SD = 42.30$ sec) before continuing with the next task. A linear regression analysis showed that participants’ theories about willpower significantly predicted the length of the break, $R^2 = .12$, $\beta = .34$, $b = 14.44$, $se = 5.80$, $t(47) = 2.49$, $p = .016$, 95% CI [2.78, 26.11]. Figure 4 shows that the more participants agreed with a limited-resource theory the longer they took their break. The scatter-plot further indicates heteroscedasticity. Participants below the scale midpoint of 3.5, who agreed more with a nonlimited-resource theory, took short breaks, no longer than one minute. Participants above the scale midpoint, who agreed more with a limited-resource theory, are widely spread. Some of them took short breaks while others waited almost three times as long before continuing to the next task.

Length of the break and rest goal accessibility

Previous research indicates that a goal that was just satisfied is less accessible in the semantic network (Förster et al., 2005). Therefore we tested whether the length of the break would be positively related to reaction times to rest-related words in the lexical decision task as an indicator of reduced rest goal accessibility. Reaction times of correct response trials were cleaned for outliers as described in Study 1, by removing times shorter than 300 ms and longer than three standard deviations from the sample mean. Altogether, the exclusion rate was 5.49% of all reaction times. We regressed reaction times to rest-related words on the length of the break, controlling for reaction times to neutral words in a first block. Length of the break significantly predicted reaction times to rest-related words, $\Delta R^2 = .01$, $\beta = .10$, $b = 10.13$, $SE = 4.79$, $t(46) = 2.09$, $p = .042$, 95% CI [0.37, 19.66]. The shorter participants had rested, the faster they recognized rest-related words as words, indicating higher accessibility of a rest goal. Put differently: the longer participants had rested (i.e. fulfilled their rest goal by taking a longer break), the less accessible was the rest goal afterwards as indicated by reduced accessibility of rest-related words.

Indirect effect of theories about willpower on rest goal accessibility through length of the break

Because participants with a limited resource theory had the possibility to take a break, what many of them did, we did not expect to find a direct relationship between implicit theories about willpower and rest goal accessibility after the break. Accordingly, a regression analysis controlling for reaction time to neutral words showed that there was no direct relationship between implicit theories about willpower and reaction time to rest-related words in the lexical decision task, $t(46) < 1$. However, we assumed that there would be an indirect effect of willpower theories on rest goal accessibility through the length of break, despite the absence of a direct effect (Hayes, 2009; Rucker, Preacher, Tormala, & Petty, 2011). Satisfying the rest goal should lead to lower rest goal accessibility. Therefore, we tested whether there was an indirect effect of participants' theories about willpower on post-break rest goal accessibility through length of the break. We did so using the INDIRECT macro for SPSS (Preacher & Hayes, 2008), which uses bootstrapping to estimate

the indirect effect of an independent variable (i.e., theories about willpower) on a dependent variable (i.e., rest goal accessibility) through a mediator (i.e., length of the break). Reaction times to neutral words were controlled for in the analysis. The overall model was significant, $R^2 = .88$, $F(3, 45) = 127.79$, $p < .001$. As reported earlier, there was a main effect of willpower theories predicting length of the break, $b = .34$, $se = .14$, $t(45) = 2.42$, $p = .024$. The effect of length of the break on reaction times to rest words was also significant, $b = 12.14$, $se = 5.03$, $t(45) = 2.42$, $p = .019$. The longer participants had rested the slower they were in recognizing rest words as words. The indirect effect based on 5000 bootstrap samples was different from zero, 95% CI [.52, 11.88]. As expected, the direct effect of willpower theories on reaction times to rest words was non-significant, $b = -6.78$, $se = 5.20$, $t(45) = -1.30$, $p = .20$. These results suggest that participants with a limited theory about willpower rested longer and that the longer they rested the less accessible was the rest goal.

Discussion

Study 4 provides further support for the hypothesis that after self-control exertion the motivation of participants with a limited-resource theory turns toward rest as indicated by a behavioral measure of rest taking. The more participants endorsed a limited-resource theory the longer they rested before continuing with another task. Whereas participants with a nonlimited-resource theory uniformly decided for a very short break, there was much more variance in the time participants with a limited-resource theory rested before continuing with the second study. Further, the scatter-plot suggests that an unknown moderator is involved in these participants' decision to rest. One may speculate that some of them decided to postpone the break until after the task. The positive relationship between the length of the break and reaction times to rest-related words in the lexical decision task suggests that participants who took a longer break, and these were participants with a limited resource theory, thereby fulfilled their rest goal. After they had rested the goal was no longer active.

In summery, Study 4 provides first evidence for the effect of implicit theories on actual rest-taking behavior in a reduced design in which all participants had been depleted. However, the

correlational nature of the study prevents causal interpretations. Because depletion was not manipulated, it is unclear whether resting behavior was caused by the previous self-control exertion. Similarly, because participants' willpower theories were measured, a third variable, associated with a limited theory about willpower, could have accounted for the longer breaks. Therefore, in Study 5, we manipulated depletion as well as participants' theories about willpower in a fully-crossed design.

Study 5

Study 5 sought to show that an induced limited theory about willpower would lead to longer resting behavior only in participants who had previously exerted self-control. Resting behavior was assessed with an ostensible product-testing task: participants were asked to take a seat on several chairs and to rate them later on. A hidden camera filmed the product-testing session and participants' sitting times on each chair were recorded afterwards. We used the length of time sitting on the chairs as the indicator for the need to rest after self-control exertion since it provides an opportunity to relax and to fulfill one's rest goal.

Method

Participants. Ninety-four students from a German university participated in the experiment. in exchange for course credit (psychology undergrads) and sweets (all participants). They were randomly assigned to the limited versus nonlimited theory condition and low versus high depletion condition. Film materials of nine participants could not be analyzed because the camera did not work properly. One further participant was removed from the sample because she was not proficient in the German language. The final sample ($N = 84$) contained 63 females with a mean age of 22.90 ($SD = 4.70$).

Procedure. Participants took part individually. After they had completed a short demographic survey, implicit theories about willpower were manipulated with the same biased questionnaire used in Study 3, with low values representing high agreement with the induced theory. One-sample t -tests comparing the mean in each condition to the scale midpoint (3.50)

indicated that participants agreed with the suggested theory in both the limited theory condition ($M_{diff} = -1.18$, 95% CI [-1.38, -0.98]), $t(40) = -11.61$, $p < .001$, and the nonlimited theory condition ($M_{diff} = -1.21$, 95% CI [-1.42, -1.02]), $t(42) = -12.53$, $p < .001$.

Next, we manipulated self-control exertion in two different ways. First, participants wrote an essay about their morning routine while inhibiting the use of two specific letters (Mead, Baumeister, Gino, Schweitzer, & Ariely, 2009; Schmeichel, & Vohs, 2009). In the high depletion condition they were instructed not to use any words containing the letters 'a' and/or 'n'. Both are frequently used letters in German language (Best, 2005). This task requires self-control because participants repeatedly have to override their prepotent tendency to use words containing 'a' and/or 'n' and search for alternatives instead. In the low depletion condition, participants were instructed not to use the letters 'x' and/or 'y', which are amongst the most rarely used letters in German language (Best, 2005). Therefore, this version of the task does not require self-control. Participants were instructed to write until the experimenter would stop them, which s/he did after 8 minutes.

Second, participants performed a verbal Stroop task for 6½ minutes in which they were asked to read aloud the words presented to them. Stimuli were written on 3 sheets of laminated paper, each depicting three rows of 24 words for a total of 72 on every sheet. In the high depletion condition, words were written in four different colors and the ink color was always incongruent to the semantic meaning of the words (e.g., the word "red" written in blue ink). Thus, participants had to repeatedly override the impulse to name the color of the ink instead of the semantic meaning of the word. In the non-depletion condition all words were printed in black ink. The Stroop task has been frequently used to manipulate ego depletion in previous research (e.g., DeWall, Baumeister, Stillman, & Gailliot, 2007; Vohs, Baumeister, & Ciarocco, 2005).

After completing the Stroop task, participants were told that they had finished the experiment and were asked to participate in an unrelated, short market research study that would involve testing seating furniture. All subjects agreed to participate. They were led to an adjoining room in which they saw 6 different chairs. Chairs were labeled with numbers from 1 to 6 and

participants were instructed to sit on them in this order. They were told that they could sit on each chair as long as they liked, but that they would be allowed to sit only once on each chair. They were also told that they should behave naturally while sitting on the chairs and that after having tested all chairs, they would be asked to rate each of them. The experimenter then left the room so that participants could try out the chairs without being watched.

After trying all six chairs, participants called the experimenter, who had waited in an adjoining room. Participants then answered 15 questions to rate the chairs. Participants rated how comfortable each chair was on a 6-point scale. The remaining 9 items asked which chair the participant would prefer in a certain context (e.g., which chair they would recommend to their friends). These ratings served to bolster the cover story of the product-testing task. Because our focal dependent variable was sitting time on the chairs, all ratings were collected after participants had sat on all six chairs. Collecting the ratings in between the periods of sitting on the chairs could have interfered with the natural sitting behavior.

To allow us to determine the exact time each participant sat on each chair a hidden camera filmed the product-testing phase. The camera was placed in a shelf filled with office supplies at waist level so that participants' faces were not filmed. Right before a given participant entered the room, the experimenter said that s/he needed to check if the room was available. The experimenter briefly entered the room alone and turned on the camera. After data collection was completed, trained raters determined the sitting times for each participant. At the end of each session, participants were debriefed and informed about the hidden camera. They were asked for written permission for the use of the video material. All participants agreed.

Results

Sitting times

Times sitting on each chair were cleaned for outliers by removing times which were longer than three standard deviations from the mean of each chair within each experimental condition. This resulted in the exclusion of 2% of sitting times. Since the distribution of the remaining times was

skewed, sitting times were ln-transformed before further analyses.

Since times sitting on each chair were nested within participants we ran a hierarchical linear model to test the hypothesis that the depletion condition interacts with induced theory. Time sitting on each of the six chairs served as the trial-level dependent variable. Participant-level predictors were ego depletion condition (low vs. high depletion), theories about willpower condition (nonlimited vs. limited), and their interaction term. There was a significant interaction between theory condition and depletion condition, $b = .31$, $SE = .14$, $t(489) = 2.19$, $p = .029$, 95% CI [0.04, 0.58] (Figure 5). Participants in the limited theory condition sat on average longer on the chairs when they had completed a depleting self-control task as compared to when they had completed a non-depleting task $b = .26$, $SE = .10$, $t(489) = 2.66$, $p = .008$, 95% CI [0.06, 0.46]. For participants in the nonlimited theory condition, whether they had participated in the depleting or non-depleting task did not affect the time they spent sitting on the chairs, $b = -.04$, $SE = .10$, $t(489) = 0.42$, $p = .674$, 95% CI [-0.24, 0.16]. Within the high depletion condition, there was a trend for participants in the limited theory condition to sit longer on the chairs as compared to participants in the nonlimited theory condition, as expected, $b = .17$, $SE = .10$, $t(489) = 1.75$, $p = .081$, 95% CI [0.03, 0.37]. In the low depletion condition, there was no effect of induced theory, $b = -.14$, $SE = .10$, $t(489) = -1.37$, $p = .171$, 95% CI [-0.34, 0.06].

Next, we tested whether the order of chairs had an effect on participants' sitting times. Did the effects of theories about willpower and depletion last across all six chairs? We ran the same hierarchical model including order of the chairs as a trial level predictor additionally testing for cross level interactions with the depletion and willpower theory conditions. This analysis showed no effect of order and there was no hint toward a cross-level interaction, $t(485) < 1$.

Chair ratings

We ran the same HLM analysis described above with the comfort ratings of each chair, which were made retrospectively after participants had tried each chair, as the dependent variable. Neither the main effects of depletion condition or theories about willpower nor their interaction

reached significance, $t_s < 1$, as expected. Including the chair ratings as a trial level predictor in the above analysis of sitting times showed a significant main effect for the comfort rating, $b = 0.14$, $SE = 0.04$, $t(485) = 3.35$, $p = .001$, 95% CI [0.06, 0.22], without altering the pattern of results described above. Participants sat longer on chairs, which they rated as more comfortable. However, there was no interaction of perceived comfort with the experimental conditions.

Discussion

The results of Study 5 support the hypothesis that implicit theories about willpower predict how long individuals rest after a depleting task. Only participants with a limited-resource theory sat longer on the chairs of the ostensible product-testing task after they had worked on a previously depleting self-control task as compared to a non-depleting control task. Participants with a nonlimited theory showed no difference between the two depletion conditions. Importantly, in Study 5, theories about willpower were manipulated, which further underlines their causal effect on resting behavior after depletion.

General Discussion

The results of five studies support the proposal that exerting self-control in an initial task causes a motivational shift toward rest in individuals who believe that willpower is a limited resource. After the exertion of self-control, individuals with a limited-resource theory showed enhanced accessibility of rest-related concepts (Study 1), more positive evaluations of objects that are helpful for rest (Studies 2 and 3), more negative evaluations of objects that support physical exertion (Study 2), and more inactive, resting behavior (Studies 4 and 5) as compared to participants with a nonlimited theory. Moreover, Study 4 showed that to the extent participants fulfilled their rest goal by taking a break subsequent accessibility of rest-related concepts was reduced.

Theoretical Implications

The present data support the process model of self-control (Inzlicht & Schmeichel, 2012; Inzlicht et al., 2014). The model denies the existence of a self-control resource and explains ego

depletion effects by shifts in motivation and attention after initial self-control exertion. It postulates that after having expended effort in a strenuous task, people are less motivated to expend further effort. This assumption is based on numerous findings showing that after a depleting task people are still able to exert self-control given, for example, high motivational incentives (e.g., Muraven & Slessareva, 2003). These and several other moderators of the ego depletion effect have documented that in the common dual task paradigm reduced self-control may not be caused by a shortage in actual self-control capacity but has primarily a motivational source. However, even though the motivational shift hypothesis is compatible with much empirical data, there is little evidence actually showing changes in motivational orientation after depletion. Most studies on the ego depletion effect have not assessed participants' motivation to complete the tasks. The few studies that asked participants how motivated they were to complete the dependent self-control task did not find evidence for differences in self-reported motivation between depletion and control conditions (Boucher & Kofos, 2012; Clarkson, Hirt, Jia, & Alexander, 2010; Muraven, Rosman, & Gagne, 2007). Our findings deliver first support for the process model's motivational shift assumption, documenting differences in motivational orientation between depleted and nondepleted participants.

However, our research shows that there is one important specification: only individuals who believed (or were led to believe) that the ability to self-control is limited showed the predicted motivational orientation toward rest. This finding suggests that it is the limited-resource belief that makes people seek rest as soon as they have engaged in a relatively short self-control exercise. We assume that it is this motivational orientation towards rest that undermines their subsequent self-control performance. This perspective suggests that a nonlimited-resource theory buffers the ego depletion effect because it breaks a process that undermines self-control performance by turning people's attention toward rest and inaction. For this reason, a nonlimited theory about willpower cannot simply be grouped together with factors that boost motivation after depletion, such as monetary incentives to perform well on a second task (Muraven & Slessareva, 2003). Strong incentives may cause people to exert high effort on a task even when they feel tired. In this case

they might conquer the need for rest and inhibit their activated rest goal. On the contrary, the belief that willpower is not limited does not make people more motivated to engage in self-control despite exhaustion and a desire for rest. In fact, there is no increased desire for rest in people with a nonlimited theory about willpower. There is no need to cherish rest and recovery for individuals who believe they can continue exerting strength for long periods of time. Rather, they show better self-control performance because they do not slack off, not because they are exceptionally motivated to overcome depletion.

Future Directions and Unresolved Issues

The present research demonstrates that people with a limited-resource theory as compared to people with a nonlimited theory show enhanced motivational orientation toward rest after a relatively short self-control exercise. The present research does not speak to the question of how far effects of theories about willpower reach when periods of self-control exertion are extended. It is possible that when forced to exert self-control for a very long time people with a nonlimited theory about willpower would turn toward rest as well (Vohs et al., 2013). Everyone will feel tired or hungry eventually. Future research should therefore investigate motivational shifts after ego depletion of varying duration. Importantly, for self-regulatory performance in everyday life the later onset of rest goal activation puts people with a nonlimited-resource theory of willpower in an advantageous position. As compared to people with a limited-resource theory, who turn towards rest after they have exerted just a little self-control, people who believe that willpower is not limited do well when self-regulatory demands are high, for example during students' final exams (Job et al., in press).

The present research combined quasi-experimental and experimental designs by either measuring implicit theories about willpower as a trait variable (Studies 1, 2, 4) or by manipulating them experimentally (Studies 3 and 5). Both procedures showed similar results, which speaks against the idea that theories about willpower might only be a proxy for some other personality variable (e.g., trait self-control, action orientation, conscientiousness). So far, little is known about

the relationship between individual differences in theories about willpower and other individual difference variables in the nomological network. Study 3 of the present research together with previous research shows that the correlation between a limited-resource theory and trait self-control ranges from $-.17$ to $-.52$ (see Footnote 3; Job et al., in press; Job et al., 2010; Salmon et al., 2014). Further, Study 3 showed a significant correlation between a limited-resource theory and achievement motivation ($r = -.42$). Although these findings reveal preliminary evidence for the relationship between theories about willpower and other pertinent personality scales, they should be interpreted with caution because they were obtained from studies with other focal goals. Clearly, more comprehensive work is needed to anchor individual differences in theories about willpower in the personality space

Conclusion

The present findings show that people's beliefs about the nature of willpower operate via their goals. When people believe that willpower is limited they strive for rest and recovery after they exerted self-control. People who believe that willpower is not limited do not turn towards rest after self-control exertion. Therefore, the belief that willpower is nonlimited prevents or delays the onset of a process that turns people toward rest once they started to work hard. As a consequence, people with a nonlimited theory may take fewer unnecessary breaks from self-control and may ultimately be more successful at attaining important long-term goals.

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Footnotes

¹ For reasons beyond the scope of the present research, we also assessed implicit motives with a picture story exercise (PSE; Schultheiss & Brunstein, 2001) immediately after the depletion manipulation. Participants were asked to write four imaginative stories based on picture cues (duration: 10 to 12 minutes). In addition, after Study 2 was completed, participants worked for another 20 minutes on a set of tasks and questionnaires to pilot material for a different research project.

² The original set of 20 pictures contained three further pictures of sports related energy food (Dextro Energy, Isostar, and a power bar). According to the pilot study they belong to the control category: they are perceived as moderately conducive for rest and require rather little effort. However, since they are ambiguous regarding their associations with physical exertion and restoration of energy, we refrained from reporting them in the present research. However, including them in the control category does not alter the reported results.

³ Participants additionally filled in the following questionnaires for reasons beyond the scope of this research (correlations with limited willpower theory are provided in parenthesis): a measure of mind-body dualism ($r = -.10, p > .25$, Forstmann, Burgmer, & Mussweiler, 2012), trait self-control scale ($r = -.30, p = .038$, Tagney, Baumeister, & Boone, 2004), and the achievement motive scale ($r = -.42, p = .003$, Lang & Fries, 2006).

⁴ The experimental manipulation did neither affect the length of break, nor rest goal activation in the lexical decision task, nor was it related to theories about willpower, $ts(47) < 1$. Controlling for it in the reported analyses had no discernable effect on the reported results.

Figure Captions

Figure 1. Response latencies to rest-words, controlling for response latencies to neutral words, as a function of depletion condition and implicit theory about willpower at ± 1 *SD* (Study1).

Figure 2. Evaluation of rest- (a) and exertion- (b) conducive objects, controlling for evaluation of neutral objects, as a function of depletion condition and implicit theories about willpower at ± 1 *SD* (Study2)

Figure 3. Evaluation of rest-conductive objects, controlling for evaluation of neutral objects, as a function of depletion condition (a) and perceived depletion (b), respectively, and induced theory about willpower condition (Study 3).

Figure 4. Scatterplot matrix of length of break (vertical axis) and theory about willpower (horizontal axis) (Study 4).

Figure 5. Mean time sitting on the chairs as a function of depletion condition and induced theory about willpower condition (Study 5).

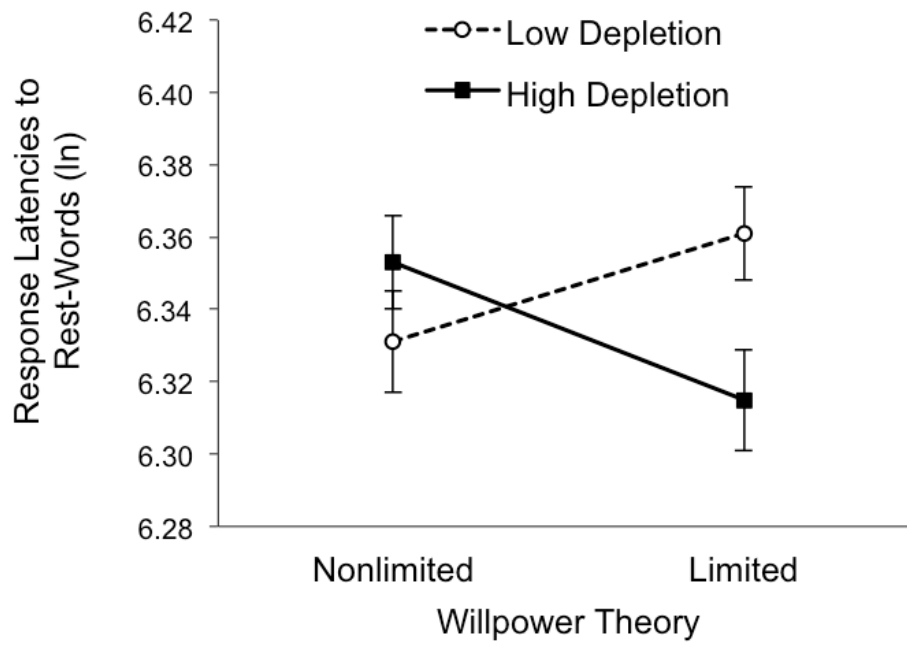


Figure 1

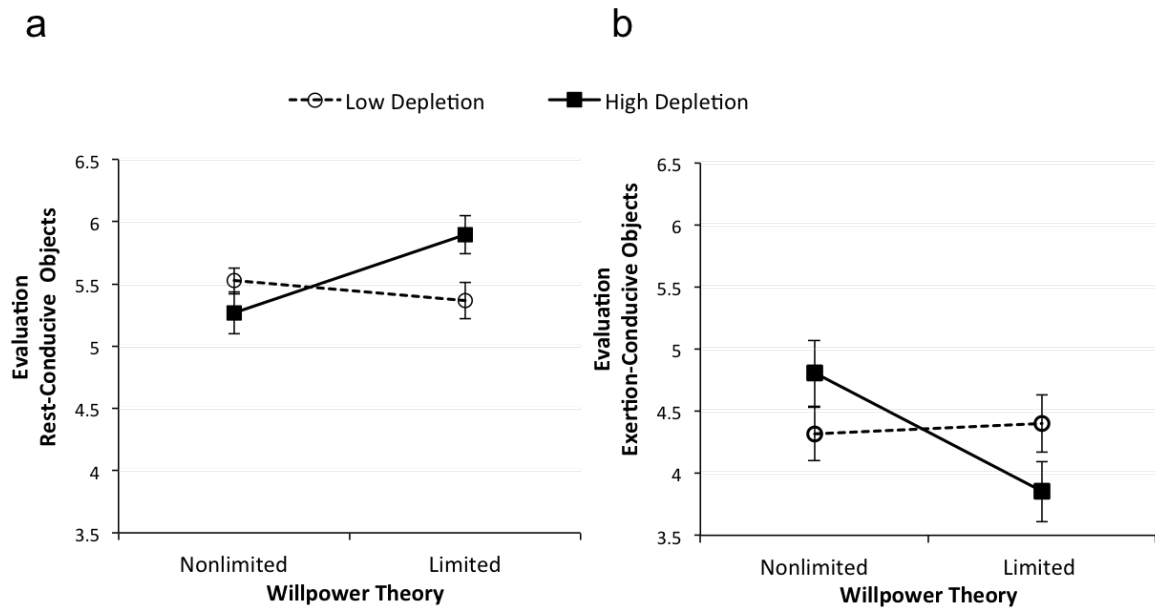


Figure 2

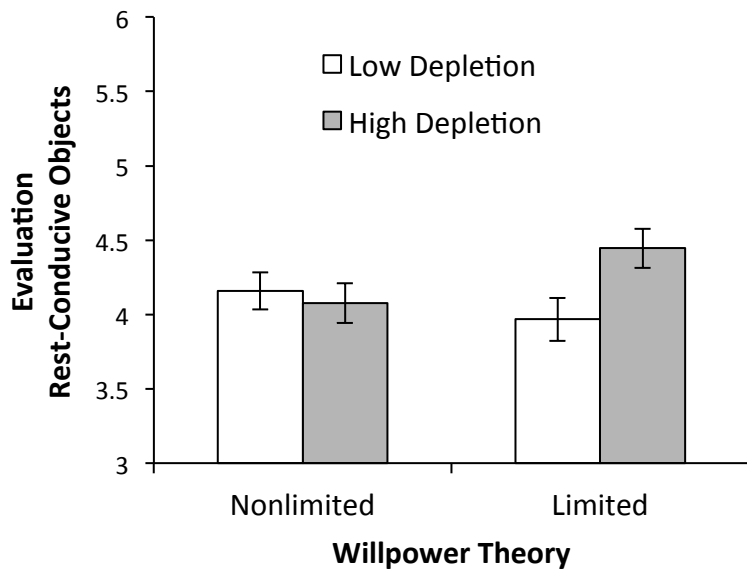


Figure 3

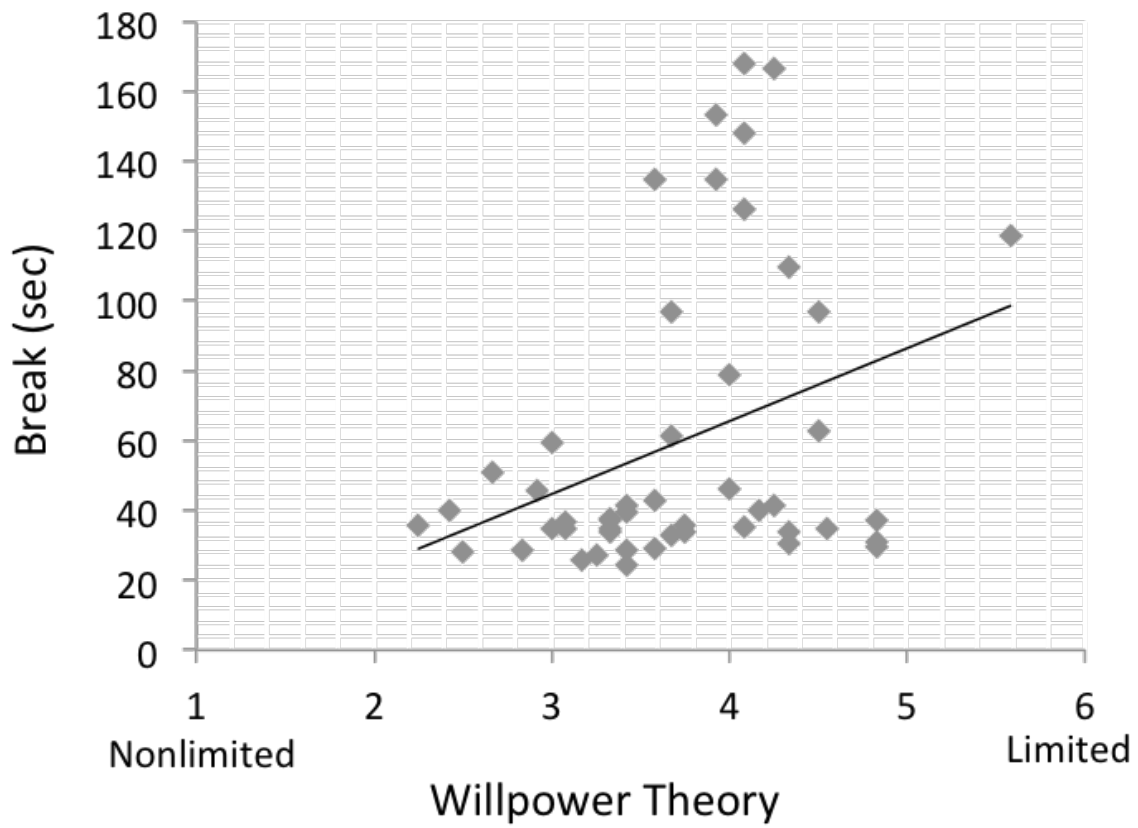


Figure 4

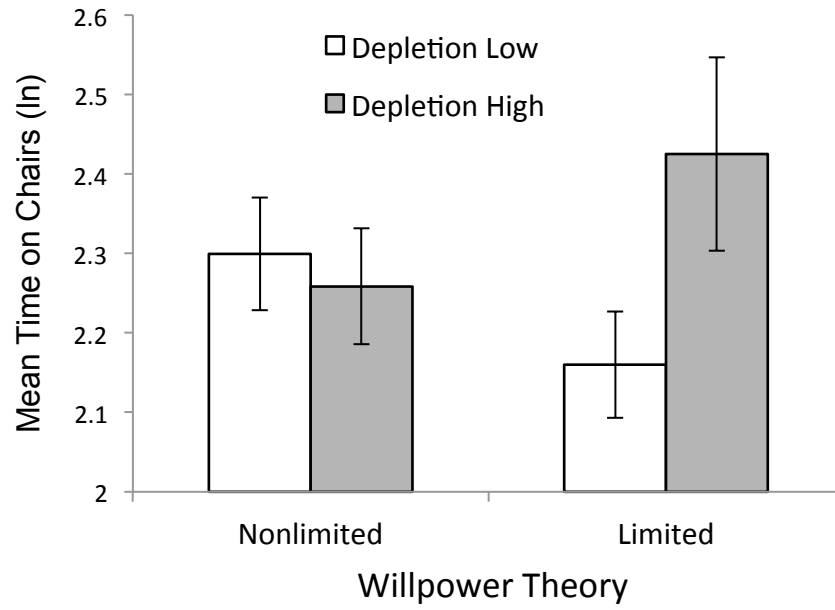


Figure 5