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Ego depletion and the use of mental contrasting

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Abstract Mentally contrasting a desired future with present reality leads to goal pursuit in accordance with people's expectations of realizing the desired future. Because mental contrasting is a purposeful self-regulation strategy that involves mental effort and complex information processing we suspected that people who are depleted or mentally fatigued are less likely to mentally contrast than those who are not. Indeed, participants who performed a depleting first task were less likely to subsequently mentally contrast about an important personal wish than those who performed a nondepleting first task. However, activating the desired future and present reality by priming (Study 1) or increasing the demand for mental contrasting by confronting participants with an impending task (Study 2) counteracted the effect of depletion on the reduced use of mental contrasting. We discuss implications for the use of mental contrasting and the strength model of self-control.

Keywords Self-regulation · Mental contrasting · Ego depletion · Expectations · Content analysis · Spontaneous thought

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Introduction

People constantly face decisions whether to commit to a certain course of action or not. Mentally contrasting a desired future with obstacles in the present reality that stand in the way of the desired future is a self-regulation strategy that helps people to selectively invest their inherently limited resources (e.g., effort, time, money) to pursue feasible goals and keeps them from wasting their resources on unfeasible ones (Oettingen 2012). Given that mental contrasting is an effective self-regulation strategy it is important to ask when people use mental contrasting. Here, we explored the effect of depletion (i.e., mental fatigue; Baumeister et al. 1998; Muraven and Baumeister 2000; Wright 2013) on the use of mental contrasting. Because the use of mental contrasting involves mental effort (Achtziger et al. 2009) we suspected that people who are (vs. not) depleted might be less likely to mentally contrast. Moreover, if depletion led to reduced use of mental contrasting, it would be important to investigate how to counteract this effect. Therefore, we examined whether activating the desired future and present reality by priming leads people to mentally contrast even though they are depleted. Similarly, increasing the demand for mental contrasting by confronting participants with a goal-relevant task should foster mental contrasting when people are depleted.

Mental contrasting

When people use mental contrasting, they start with naming an important wish they would like to realize (e.g., "earning a higher salary"). Then they imagine the desired outcome they associate with having realized their wish (e.g., "feeling more secure") and directly thereafter they

mentally elaborate the present reality standing in the way of realizing their wish (e.g., "not speaking up"). Imagining the desired future followed by the present reality strengthens mental associations between the future and reality (Kappes and Oettingen 2014), between the reality and instrumental means to overcome the reality (Kappes et al. 2012b), and people interpret the reality as a relevant obstacle (Kappes et al. 2013) provided they have high expectations of realizing the future. When people have low expectations, mental contrasting weakens the future-reality associations. As a consequence, when expectations are high, people will mobilize effort to pursue the desired future; when expectations are low, they will let go from realizing the desired future (summary by Oettingen 2012). Imagining only the desired future (indulging), only the present reality (dwelling), or elaborating the reality before the future (reverse contrasting) do not activate expectations and do not depict the reality as an obstacle, because the reality is not elaborated in the context of the desired future (Kappes et al. 2012b; Kappes et al. 2013; Oettingen et al. 2001).

The effect of mental contrasting on selective effort and goal pursuit is supported by a large number of studies (summary by Oettingen 2012). These studies measured goal pursuit using various indicators including cognitive (e.g., making plans), affective (e.g., feelings of anticipated disappointment in case of failure), motivational (e.g., feelings of determination), physiological (e.g., energization assessed by cardiovascular measures), and behavioral (e.g., number of initiated actions) indicators. The pattern emerged whether these indicators were self-reported or observed, whether they were assessed immediately after the mental exercise or weeks later, and whether mental contrasting was experimentally induced or self-generated (Oettingen 2000; Oettingen et al. 2012; Oettingen et al. 2009; Oettingen et al. 2010; Oettingen et al. 2001; Sevincer et al. 2014a; Sevincer and Oettingen 2013, 2015a).

Measuring mental contrasting

Whereas the majority of studies on mental contrasting have investigated the effects of experimentally induced mental contrasting on effort and goal pursuit, researchers also measured people's spontaneous use of mental contrasting (Sevincer and Oettingen 2013). To measure the use of mental contrasting, they asked participants to name and freely write about an important wish (e.g., "finding a new partner") and content analyzed the written elaborations. Participants who wrote about the desired future followed by the present reality were identified as mentally contrasting; those who wrote about the desired future only as indulging, those who wrote about the reality only as dwelling, and those who wrote about the reality followed by the future as reverse contrasting. When self-regulatory thought was measured in this way the majority of participants typically engaged in one-sided modes of thought (indulging or dwelling) and only a minority engaged in two-sided modes of thought (mental contrasting and reverse contrasting). Of importance, just as induced mental contrasting, such unobtrusively observed mental contrasting (vs. indulging, dwelling, and reverse contrasting) predicted expectancy-dependent effort and goal pursuit (Sevincer and Oettingen 2013). Here, we used this content-analytic measure to investigate the effect of depletion (i.e., mental fatigue) on the use of mental contrasting.

The strength model of self-control

According to the strength model of self-control (Baumeister et al. 1998; Muraven and Baumeister 2000) self-control refers to instances when people attempt to change the way they would otherwise think, feel, or act (Muraven and Baumeister 2000). In other words, by exerting self-control people override predominant responses. Furthermore, the model posits that acts of self-control require a common resource. This resource is limited and exerting self-control depletes people's reservoir of that resource. That is, after performing acts of self-control people experience a state of depletion during which subsequent acts of self-control are prone to fail. Most studies on the strength model use a sequential-task paradigm, in which participants perform a first task that either requires self-control (e.g., suppressing the thought of a white bear while imagining visiting a zoo) or does not require self-control (e.g., simply imagining visiting the zoo). Thereafter, participants perform a different second task that requires self-control and that is the same for all participants (e.g., dipping one's hand in ice water as long as possible). Typically, participants who exerted self-control (vs. not) in the first task evince a decreased performance in the second task.

To confirm that the effects of depleted self-control are domain general rather than specific, the two tasks frequently come from two different domains. These domains include: (a) controlling attention (e.g., performing a Stroop task), (b) controlling emotions (e.g., regulating affect while watching an upsetting video), (c) controlling impulses (e.g., not eating candies while on diet), (d) controlling thoughts (e.g., not thinking about a white bear), (e) cognitive processing (e.g., solving difficult math problems), (f) social processing (e.g., accommodating one's partner), and (g) choice and volition (e.g., squeezing a handgrip; Baumeister et al. 2007). Moreover, whereas the original model posits that depletion arises from exerting self-control in the sense of overriding a predominant response (Muraven and Baumeister 2000), research suggests that

performing complex mental activities (e.g., solving difficult math problems) also leads to depletion (Hagger et al. 2010; Schmeichel 2007; Wright et al. 2008). A meta-analysis found a medium-to-large effect size ($d = .62$) of depletion on self-control performance (Hagger et al. 2010). We investigated whether performing self-control in a first task reduces the likelihood to subsequently mentally contrast, because using mental contrasting (a) requires changing predominant modes of thought (indulging or dwelling), (b) involves the processing of complex information, and (c) as it does not help to replenish resources is not beneficial in a depleted state.

The present research

We had two aims: First, we investigated the effect of depletion or mental fatigue on the use of mental contrasting. Second, assuming that depleted persons are less likely to mentally contrast we explored how to reverse this effect. Specifically, we hypothesized that priming the desired future and reality (Study 1) and confronting people with an immediate task (Study 2), would counteract the depletion effect and even lead to an increased use of mental contrasting regardless of depletion.

Depletion and use of mental contrasting

We suspected that depleted (vs. non-depleted) people are less likely to use mental contrasting for three reasons: First, depleted people are less likely to override response tendencies (Muraven and Baumeister 2000). Measuring spontaneously occurring self-regulatory thought by asking participants to freely write about an important personal wish and content-analyzing the written texts, Sevincer and Oettingen (2013) found that participants indulged and dwelled rather than mentally contrasted or reverse contrasted. Specifically, about twice as many persons used the one-sided modes of thought (indulging and dwelling combined; 58 %) than the two-sided modes of thought (mental contrasting and reverse contrasting combined; 27 %). Thus, because people tend to indulge and dwell, and the use of mental contrasting requires overriding one's spontaneous stream of thought, depleted (vs. non-depleted) people should be less likely to mentally contrast.

Second, depleted (vs. non-depleted) people are less likely to engage in complex information processing (Hagger et al. 2010). For instance, because information that disconfirms (vs. confirms) one's attitudes is more laborious to process (Ditto and Lopez 1992), depleted (vs. non-depleted) participants showed an increased tendency for confirmatory information processing (Fischer et al. 2008). They also favored intuitive rather than deliberate and careful decision making (Pocheptsova et al. 2009). Finally, depleted participants not only were less likely to spontaneously engage in complex information processing, they also showed impaired performance in complex cognitive tasks, such as logic and reasoning, cognitive extrapolation, and thoughtful reading comprehension (Schmeichel et al. 2003). At the same time, numerous studies indicate that mental contrasting involves the processing of more complex information than other modes of thought. For example, in one neuropsychological study (Achtziger et al. 2009), participants' magneto-encephalographic activity was monitored while they mentally contrasted (vs. indulged or rested). Mentally contrasting participants evinced a greater activity in areas associated with strong intention formation, working memory, and episodic memory, as well as in areas associated with purposefully creating mental images. Mental contrasting also helped participants to process negative feedback more deeply (e.g., they recalled more information; Kappes et al. 2012a). Further, mental contrasting more than other modes of thought modulated the strength of implicit associations between the future and reality and the reality and instrumental means to overcome the reality which in turn predicted behavior change (Kappes and Oettingen 2014; Kappes et al. 2012b). Finally, mental contrasting more than other modes of thought led people to interpret the reality as an obstacle to wish fulfilment (Kappes et al. 2013). In sum, because depleted (vs. non-depleted) people are less likely to engage in processing of complex information and mental contrasting involves such processing, depleted people should be less likely to mentally contrast.

Third, the use of mental contrasting in a depleted state should hinder people to replenish their resources. According to the energy conservation principle (Richter 2015; Silvestrini and Gendolla 2013), people are motivated to conserve effort. For example, when performing a task people do not expend more effort than is necessary and worthwhile to successfully complete the task (motivational intensity theory, Brehm and Self 1989; Wright 1996). Because depleted people have fewer resources available to exert effort than they normally would, they should be even more motivated to conserve their remaining resources at least until their resources are replenished. As a consequence people should be less likely to mentally contrast when depleted than when not depleted. In this view, in a depleted state it is beneficial to indulge or dwell rather than mentally contrast to conserve effort. In line with this idea, research suggests that people indeed strategically manage their resources (Muraven et al. 2006).

Counteracting the effect of depletion on the use of mental contrasting

A number of factors counteract the impairing effects of depletion on subsequent performance. For example, engaging in self-affirmation (Schmeichel and Vohs 2009), increasing self-monitoring (Alberts et al. 2011; Wan and Sternthal 2008), using implementation intentions (Webb and Sheeran 2003), believing that self-control is *not* limited (Job et al. 2010), being strongly motivated to exert self-control (Muraven and Slessareva 2003), being in a positive mood (Tice et al. 2007), being primed with persistence (Martijn et al. 2007), and exerting self-control for autonomous reasons (Moller et al. 2006; Muraven 2008; Muraven et al. 2008) alleviated depletion effects. We explored two factors that might counteract the hypothesized effect of depletion on the reduced use of mental contrasting: Mentally activating the desired future and reality by priming and increasing the demand to use mental contrasting by confronting participants with an immediate goal-relevant task.

Priming future and reality

When Sevincer and Oettingen (2013) instructed participants to freely write about an important wish, only about 10 % of the participants mentally contrasted; when however the researchers primed the desired future and present reality by alluding to the desired future followed by the present reality in participants' instructions, the rate of mentally contrasting participants increased to 59 %. When the researchers primed the desired future only, the rate of indulging participants substantially increased from 33 to 64 %; when they primed the present reality only, the rate of dwelling participants substantially increased from 32 to 71 %. Priming the desired future only however did not increase the number of mentally contrasting participants (21 %) as substantially as priming future and reality, and priming the reality only even tended to decrease the number of mentally contrasting participants (2 %). We interpret these findings such that priming the desired future and present reality activated both concepts rather than only one concept in participants' minds. When both concepts are activated it should come easier to people to override predominant modes of thought—indulging and dwelling, in which only one concept is activated—with mental contrasting.

On the basis of these findings, we hypothesized that priming participants with the desired future and present reality would increase the use of mental contrasting and thus counteract the effect of depletion on the reduced use of mental contrasting. We suspected that this could be the case because priming does not necessarily require effortful processing (Bargh and Chartrand 2000). Thus, even though depleted participants' capacity to exert effortful processes is reduced, the priming manipulation should be effective in activating both the desired future and present reality in people's mind. Once the desired future and reality are activated, it should come easier to participants to mentally contrast regardless of depletion. In support of the idea that priming can offset depletion effects on self-regulation, in one study (Martijn et al. 2007) researchers primed participants by providing stories about persistent persons (e.g., an ice-skater who won the Olympics despite severe setbacks). Priming depleted participants in this way alleviated the typical depletion effect on performance (squeezing a handgrip).

Anticipating a goal-relevant task

Second, we investigated whether increasing the demand to engage in mental contrasting would foster mental contrasting when people are depleted. Evidence that people use mental contrasting when the demand for self-regulation is high comes from a study by Kappes et al. (2011). Because mental contrasting is a purposeful problem-solving strategy, and sad mood indicates the presence of a problem, the researchers predicted and found that participants were more likely to use mental contrasting (vs. indulging, dwelling, and reverse contrasting) when they were in a sad (vs. happy or neutral mood). Whereas Kappes et al. (2011) increased the demand for mental contrasting by inducing sad mood, we operationalized demand for mental contrasting in another way, namely by confronting participants with a task relevant for realizing their desired future.

Mental contrasting helps people to effectively approach goal-relevant tasks. When dyads were asked to succeed in an integrative bargaining task, those who were led to mentally contrast used more successful bargaining strategies and achieved higher joint gains than those who were led to indulge, dwell, or received no particular instructions (Kirk et al. 2011). Further, participants taught to apply mental contrasting (vs. indulging) towards their specific every-day life tasks reported more success in managing their time, making decisions, and mastering their every-day life (Oettingen et al. 2010). Thus, because mental contrasting helps people solving immanent goal-relevant tasks people should be more likely to spontaneously use mental contrasting when they are confronted with such tasks.

Preliminary evidence that people use mental contrasting when they are confronted with a task relevant for realizing a specific desired future comes from a pilot study by Sevincer and Oettingen (2015b). Participants first named their currently most important interpersonal wish. Thereafter, to manipulate high versus low demand for mental

contrasting all participants were presented with a tutorial. In the low-demand condition participants were told that the tutorial is about training skills that are irrelevant to realizing their wish—spelling skills; in the high-demand condition they were told that the tutorial is about training skills that are relevant to realizing their interpersonal wish—interpersonal skills. Finally, the researchers assessed spontaneous mental contrasting. As predicted, participants used more mental contrasting when they were confronted with the goal-relevant task (performing a tutorial to train interpersonal skills) than when they were confronted with the goal-irrelevant task (performing a tutorial to train spelling skills).

Drawing on the above finding, we investigated whether increasing the demand to use mental contrasting by confronting participants with a goal-relevant task would lead them to use mental contrasting even when they are depleted. Previous research on the strength model suggests that people can overcome depletion effects on performance when the demand or necessity to solve a task is high (Hagger et al. 2010). For example, depleted participants who were motivated to perform a self-control task because they believed performing the task would benefit themselves or others showed less performance decrements (Muraven and Slessareva 2003). Therefore, we suspected that presenting participants with an immediate goal-relevant task would counteract the effect of depletion on the reduced use of mental contrasting and increase the use of mental contrasting.

Study 1: priming future and reality

Study 1 had two aims: First, we investigated whether depletion leads to a reduced use of mental contrasting. To deplete (vs. not) participants, they first performed either a task that required self-control (a thought suppression task) or a task that did not require self-control. Thereafter, we assessed self-regulatory thought with regard to an interpersonal wish. Second, to investigate whether priming (vs. not) the desired future and present reality would counteract the effect of depletion on the use of mental contrasting, following Sevincer and Oettingen (2013) we either alluded to the desired future and present reality when asking participants to write about their wish or we just asked them to freely write about their wish. Finally, because depletion effects on self-regulatory thought may be influenced by (a) people's general self-control skills (Baumeister and Heatherton 1996) and (b) their beliefs about whether their self-control capacity is limited or unlimited Job et al. 2010, 2015) we also assessed these two variables. We hypothesized that, first, depleted (vs. non-depleted) participants would be less likely to mentally contrast. Second, that priming the desired future and reality would increase the use of mental contrasting for the non-depleted as well as the depleted participants. Because depleted participants should show a reduced use of mental contrasting, priming future and reality may increase the use of mental contrasting even more for the depleted than the non-depleted participants.

Methods

Participants and design

Participants were 215 undergraduate students from a large German University (125 female, $M_{age} = 23.0$ years). A meta-analysis estimated a medium-to-large effect size ($d = .62$) of depletion effects on performance (Hagger et al. 2010). Given a critical alpha of .05, a power of .8 (Cohen 1969), and a medium effect size of $d = .6$, we calculated a minimum size of 45 participants per group (G*Power Analysis; Faul et al. 2007). Students were recruited on campus for an online study on life tasks and imagination. We used a 2 (depletion: non-depleted vs. depleted) × 2 (prime: no prime vs. future-reality prime) design.

Procedure

Interpersonal wish, expectations, and incentive value Students first named their currently most important interpersonal wish using the same instructions as Sevincer and Oettingen (2013). They named for example: "Resolve conflict with a friend". Thereafter, following the same procedure as past studies in which we measured mental contrasting (Sevincer and Oettingen 2013; summary by Oettingen 2012), we assessed students' expectations of success by asking: "How likely do you think it is that you will realize your wish?" We used a 7-point scale ranging from 1 (*not at all likely*) to 7 (*very likely*). Measuring expectations served the purpose to explore whether high versus low expectations influence the use of mental contrasting and to assure that our hypothesized pattern is not due to variations in expectations (Kappes et al. 2011).

Moreover, following past research (Sevincer and Oettingen 2013; Oettingen 2012), we also measured students' incentive value of their wish by asking: "How important is it to you that you will realize your wish?" We used a 7-point scale ranging from 1 (*not at all important*) to 7 (*very important*). Measuring incentive value served the purpose to verify that students followed our instructions to name wishes that are highly important to them. Moreover, it allowed us to explore whether a high versus low incentive value influences the use of mental contrasting and to

assure that our hypothesized pattern is not due to variations in incentive value.

Depletion manipulation We used a thought-suppression task (Wegner et al. 1987) that has been successfully used to deplete students (Fischer et al. 2007, 2008; Muraven et al. 1998). We asked all students to imagine a visit to the zoo and to write down their thoughts. Whereas students in the non-depleted condition did not receive any additional instructions, students in the depleted condition were instructed not to think about a white bear. Whenever they thought of a white bear, they were to suppress this thought and continue thinking about other animals and situations.

Priming future and reality and assessment of self-regulatory thought To assess whether students mentally contrasted, we used the procedure by Sevincer and Oettingen (2013): We asked students to think about their wish and write down their thoughts. We embedded the priming manipulation (no prime vs. future-reality prime) in the instructions. In the no-prime condition students read:

> Now we would like you to think about your wish. You are free to think about any aspects related to your wish that come to mind. Let the mental images pass by in your thoughts and do not hesitate to give your thoughts and images free rein. Take as much time and space as you need to describe your thoughts.

In the future-reality prime condition the second sentence was replaced by "For instance, you may imagine aspects of the future that you associate with having realized your wish, aspects of the present reality that impede it, or both." The instructions were the same as in Sevincer and Oettingen (2013, Study 1).

To assess self-regulatory thought, following Sevincer and Oettingen (2013), we first segmented the written elaborations into single statements. For the students who wrote a coherent text, a statement was defined as at least one subject–predicate sequence or more. Of the 215 students, 15 (7 %) listed only keywords (e.g., "forgive", "angry"). For those students, each keyword was considered as one statement. Interrater agreement for the segmentation was 85 %. If the raters disagreed, we took the larger sequence.

Thereafter, we coded each statement into one of three categories: (a) "desired future", (b) "present reality", or (c) "other". Statements coded as pertaining to the desired future included description of desired future events as well as consequences of realizing the desired future, such as feelings, material and nonmaterial gains, and improvements of the current situation. Statements coded as pertaining to the present reality included descriptions of the present reality and obstacles in the present reality to realizing the desired future. Statements coded into the category "other" included ambiguous statements, statements about past events, the self in general, and the experimental situation. Examples of the segmentation and coding are given in Sevincer and Oettingen (2013). Interrater agreement for the coding was 76 % ($\kappa = .63$). Regarding the total number of statements on which raters disagreed, for 62 % of these statements an agreement could be reached through discussion between the two raters. For the remaining 38 %, an agreement could not be reached. If an agreement could not be reached, the respective statement was coded into the category "other".

A student was classified as mentally contrasting if he or she generated at least one statement about the desired future and at least one statement about the present reality, and in addition had mentioned the future first; if the reality was mentioned first the student was classified as reverse contrasting. A student was classified as indulging if he or she generated at least one statement about the desired future but no statement about the reality and as dwelling if he or she generated at least one statement about the reality but no statement about the desired future. If a student generated only statements categorized as other we did not include him or her in any of the above categories.

Subjective self-control skill To measure subjective self-control skill, we used five items ("In everyday-life I always act in a self-disciplined and self-controlled way", "When someone provokes me, I am barely able to control my feelings", "When I am dieting it is almost certain that I am going to break the diet rules", "When someone annoys me, I do not manage to remain friendly and courteous toward that person"). The 7-point scales reached from 1 (*not at all*) to 7 (*very*). Because internal consistency of the combined scale was low ($\alpha = .55$), we dropped one item ("If I go shopping and do not plan to spend more than 50$, I also manage not to spend more than 50$"), improving internal consistency to acceptable ($\alpha = .60$).

Beliefs about self-control To measure beliefs about whether self-control is limited or unlimited we used two items from Job et al. (2010): "After a strenuous mental activity your energy is depleted and you must rest to get it refueled again" and "Your mental stamina fuels itself; even after strenuous mental exertion you can continue doing more of it" (reverse coded). The 7-point scales reached from 1 (*not at all*) to 7 (*very*). We combined the two items into one index ($\alpha = .70$, $r = .55$, $p = .001$). To conclude, students answered a short demographic questionnaire, were thanked and fully debriefed.

Results

Descriptive analyses

Students' mean expectations ($M = 4.44$, $SD = 1.56$) and the incentive value of their wish ($M = 6.32$, $SD = .89$) were well above the midpoint of the 7-point scale, indicating that they named wishes that deemed feasible and were important to them. Expectations and incentive correlated positively, $r = .31$, $p < .001$. Across conditions, 57 students (27 %) mentally contrasted, 41 (19 %) indulged, 82 (38 %) dwelled, and 27 (13 %) reverse contrasted. Eight students (4 %) generated only statements categorized as "other".

Self-regulatory thought

Table 1 depicts the number and percentages of the four modes of thought in each condition. Because very few students generated only statements from the category "other" (4 %), we omitted these students from all following analyses.

Effect of depletion on self-regulatory thought First, we tested whether depleted (vs. non-depleted) students are less likely to mentally contrast. We conducted multinomial regression analyses with the categorical self-regulatory thought variable (mental contrasting, indulging, dwelling, reverse contrasting) as dependent variable and depletion (non-depleted vs. depleted) as factor using only the non-depleted/no-prime condition and the depleted/no-prime condition. The reference category was mental contrasting.

The overall model was marginally significant, $\chi^2(3) = 6.47$, $p = .09$, $R^2 = .07$ (Nagelkerke), indicating that depletion tended to predict self-regulatory thought. Compared to the non-depleted students, the depleted students were less likely to mentally contrast than to indulge $b = -1.81$, $\chi^2(1) = 5.44$, $p = .02$, and tended to be less likely to mentally contrast than to dwell, $b = -1.30$, $\chi^2(1) = 3.33$, $p = .07$. There was no difference between the non-depleted and the depleted students in their use of mental contrasting compared to reverse contrasting, $b = -1.05$, $\chi^2(1) = 1.62$, $p = .20$. Because reverse contrasting was the least frequent mode of thought (13 %), the latter finding that reverse contrasting students did not differ from mentally contrasting students may be due to low power.

Therefore, to test whether the depleted students were less likely to use mental contrasting versus the three other modes of thought combined, we dummy-coded the categorical self-regulatory thought variable into mental contrasting (0) versus non-mental contrasting (1; indulging, dwelling, reverse contrasting combined). As predicted, the depleted (vs. non-depleted) students were less likely to use mental contrasting than the other modes of thought, $b = -1.38$, $\chi^2(1) = 4.11$, $p = .04$ (overall model: $\chi^2(1) = 4.88$, $p = .03$, $R^2 = .04$; Nagelkerke).

Priming future and reality in depleted versus non-depleted students Second, we tested whether priming future and reality would counteract the depletion effect on the reduced use of mental contrasting. Specifically, we suspected that priming future and reality would increase the use of mental contrasting more for the depleted than the non-depleted students and eliminate the difference in the use of mental contrasting between the two groups. We thus hypothesized an interaction effect of depletion (non-depleted vs. depleted) and priming (no prime vs. future-reality prime) in predicting self-regulatory thought. To test this interaction effect we conducted multinomial regression analyses with the categorical self-regulatory thought variable (mental contrasting, indulging, dwelling, reverse contrasting) as dependent variable, and depletion (non-depleted vs. depleted), priming (no prime vs. future-reality prime), as well as the interaction between the two factors as independent variables. The reference category was mental contrasting.

The overall model was significant, $\chi^2(9) = 27.29$, $p = .001$, $R^2 = .13$ (Nagelkerke), indicating that depletion interacted with priming in predicting self-regulatory thought. Specifically, depletion tended to interact with priming in predicting whether students mentally contrasted or indulged, $b = -1.60$, $\chi^2(1) = 2.71$, $p = .10$, and whether they mentally contrasted or dwelled, $b = -1.56$, $\chi^2(1) = 3.37$, $p = .07$. There was no depletion by priming interaction effect in predicting whether students mentally contrasted or reverse contrasted, $b = -1.37$, $\chi^2(1) = 1.65$, $p = .20$. As mentioned above, the latter finding that reverse contrasting students did not differ from mentally contrasting students may be due to low power.

Therefore, to test whether the depleted (vs. non-depleted) students were less likely to use mental contrasting versus the three other modes of thought combined we repeated the above analyses with the dummy-coded mental contrasting variable (mental contrasting vs. non-mental contrasting) as dependent variable. We observed the predicted depletion by priming interaction effect, $b = -1.53$, $\chi^2(1) = 3.73$, $p = .05$, indicating that priming future and reality increased the number of mentally contrasting students more for the depleted than the non-depleted students.

Control variables

Expectations and incentive value Multinomial regression analyses with the dummy-coded mental contrasting variable (mental contrasting vs. non-mental contrasting) as

Table 1 Study 1: interpersonal wish

Condition	N/n	Self-regulatory thought				
		Mental contrasting	Indulging	Dwelling	Reverse contrasting	Other
Non-depleted/no prime	56	11 (20)	9 (16)	24 (43)	9 (16)	3 (5)
Depleted/no prime	52	3 (6)	15 (29)	24 (46)	7 (14)	3 (6)
Non-depleted/future-reality prime	53	20 (38)	7 (13)	18 (34)	6 (11)	2 (4)
Depleted/future-reality prime	54	23 (43)	10 (19)	16 (30)	5 (9)	0 (0)

Number of students engaging in the different modes of thought in each condition

Percentages in parenthesis

dependent variable and the continuous expectation measure as independent variable revealed that high (vs. low) expectations predicted more mental contrasting, $b = -.29$, $\chi^2(1) = 7.10$, $p = .008$. Because however, in Study 1, dwelling was the most common mode of thought (43 %) and the dwelling participants had lower expectations ($M = 3.95$, $SD = 1.59$) than the other participants ($M = 4.75$, $SD = 1.47$; indulging, reverse contrasting, and mental contrasting combined), $t(205) = 3.71$, $p < .001$, the finding that high expectations predicted more mental contrasting is likely due to the high number of dwelling participants having particularly low expectations. We will return to this point in Study 2. Analogous analyses for incentive value revealed that incentive value did not predict mental contrasting, $b = .03$, $\chi^2(1) = .02$, $p = .87$.

To test whether our results remained significant when controlling for differences in expectations and incentive value, we repeated the respective analyses, adding the continuous expectations and incentive value measure, respectively, as a covariate into the model. Our finding that the depleted (vs. non-depleted) students were less likely to mentally contrast (vs. not) remained significant over and above expectations, $b = -1.59$, $\chi^2(1) = 5.08$, $p = .02$, and incentive value, $b = -1.45$, $\chi^2(1) = 4.35$, $p = .04$. Similarly, the depletion by priming interaction effect in predicting mental contrasting (vs. not) remained significant over and above expectations, $b = -1.76$, $\chi^2(1) = 4.74$, $p = .03$, and marginally significant over and above incentive value, $b = -1.49$, $\chi^2(1) = 3.45$, $p = .06$.

Subjective self-control skill We conducted analogous analyses for subjective self-control skill. Subjective self-control skill did not predict mental contrasting (vs. not), $b = -.03$, $\chi^2(1) = .04$, $p = .85$. Moreover, depletion continued to predict a reduced use of mental contrasting (vs. not) over and above self-control skill, $b = -1.44$, $\chi^2(1) = 4.30$, $p = .04$. Finally, the depletion by priming interaction effect in predicting mental contrasting (vs. not) remained marginally significant over and above self-control skill, $b = -1.49$, $\chi^2(1) = 3.53$, $p = .06$.

Beliefs about the limits of self-control A similar pattern emerged for students' beliefs about whether their self-control capacity is limited or unlimited: Self-control beliefs did not predict mental contrasting (vs. not), $b = -.04$, $\chi^2(1) = .10$, $p = .72$. Moreover, depletion continued to predict a reduced use of mental contrasting (vs. not) over and above self-control beliefs, $b = -1.38$, $\chi^2(1) = 4.05$, $p = .04$. Finally, the depletion by priming interaction effect in predicting mental contrasting (vs. not) remained marginally significant over and above self-control beliefs, $b = -1.53$, $\chi^2(1) = 3.71$, $p = .054$.

Number of statements generated Finally, to exclude the alternative explanation that the depleted students were less likely to mentally contrast simply because depletion lead them to write less (i.e., generate fewer statements) we tested whether the results remained significant when controlling for the number of generated statements. A higher (vs. lower) number of statements predicted mental contrasting (vs. not), $b = -.03$, $\chi^2(1) = 4.27$, $p = .04$. Moreover, depletion continued to predict a reduced use of mental contrasting (vs. not) over and above the number of statements, $b = -1.38$, $\chi^2(1) = 3.99$, $p = .04$. Finally, the depletion by priming interaction effect in predicting mental contrasting (vs. not) remained significant over and above the number of statements, $b = -1.57$, $\chi^2(1) = 3.89$, $p = .049$. This pattern speaks against the alternative explanation that the pattern is due to the depleted students simply writing less about their wish.

Discussion

Students who exerted self-control by suppressing thoughts about a white bear while imagining visiting the zoo were less likely to mentally contrast about an interpersonal wish than those who did not suppress their thoughts. Alluding to the desired future and present reality when instructing students to write about their wish, increased the number of mentally contrasting students more for the depleted students than the non-depleted students and eliminated the

difference in the use of mental contrasting between the two groups. Apparently, activating the desired future and reality by priming led students to engage in mental contrasting even though they were depleted. The effects are unlikely due to differences in students' expectations of success, the incentive value of their wish, their subjective self-control skill, their beliefs about the limits of self-control, and the number of statements they generated as the pattern of results did not change when keeping these variables constant.

In sum, we counteracted depletion effects on the use of mental contrasting by priming future and reality, thus facilitating mental contrasting. However, we did not include a manipulation check of whether students indeed experienced the self-control task as depleting. We included such a manipulation check in Study 2. Moreover, one may argue that the depleting task (thought suppression) and the spontaneous mental contrasting measure both involved purposefully directing or controlling one's thoughts and thus were from the same self-control domain. Therefore, in Study 2, to explore whether the depletion effect on the reduced use of mental contrasting is domain general rather than specific we chose a depleting task from a different domain than controlling thoughts: A controlled writing task (Pocheptsova et al. 2009) from the domain of controlling impulses (Hagger et al. 2010). Finally, we investigated whether the depletion effect can also be counteracted by increasing the demand to mentally contrast. We operationalized high demand by confronting participants with an immediate task.

Study 2: presenting a goal-relevant task

We examined whether increasing the demand to mentally contrast by confronting participants with an immediate task relevant for realizing their wish would counteract the effect of depletion on the reduced use of mental contrasting. Indeed, people may overcome depletion effects on performance when the demand to solve the task is high (e.g., when solving a task strongly benefits themselves or others; Muraven and Slessareva 2003, Studies 1 and 2). To deplete (vs. not) participants, they performed either a task that required exercising self-control (this time a writing task) or a task that did not require self-control. Following previous research (Baumeister et al. 1998), as a check of whether our depletion manipulation was successful, we asked participants to report how depleting they perceived their task to be. Thereafter, we assessed self-regulatory thought with regard to an achievement-related wish, getting one's favorite job or position. To manipulate high (vs. low) demand for mental contrasting we informed participants that directly after writing about their wish they would be taking a tutorial to train their professional skills or we did not gave them such information. We reasoned that confronting participants with a task relevant for realizing their wish to get their favorite job or position—taking a tutorial to train their professional skills—would heighten the demand for mental contrasting, because mental contrasting is a self-regulation strategy that helps people approach goal-relevant tasks (Kappes et al. 2011; Kirk et al. 2011). Finally, because sad mood fosters mental contrasting (Kappes et al. 2011), we assessed mood to rule out the alternative explanation that our hypothesized pattern is due to differences in sad mood.

We hypothesized that, first, depleted (vs. non-depleted) participants would be less likely to mentally contrast about getting their favorite job or position. Second, confronting participants with a tutorial to train their professional skills should increase the use of mental contrasting for the non-depleted as well as the depleted participants. Because depleted participants should show a reduced use of mental contrasting, presenting the tutorial may increase the use of mental contrasting even more for the depleted than the non-depleted participants.

Methods

Participants and design

Participants were 248 American internet users (127 female, $M_{age} = 36.23$ years). We determined the sample size by the same procedure as in Study 1. Participants were recruited via Amazon Mechanical Turk for an online study on personal achievement, receiving $1.00. We used a 2 (depletion: non-depleted vs. depleted) × 2 (task presentation: no task vs. task) design.

Procedure

Achievement wish, expectations, and incentive value We presented all participants with the same wish, getting their favorite job or position: "Please name your favorite job or position, that is, the job or position you would most like to get." They named for example: "Graphic designer". Thereafter, we measured expectations and incentive value in the same way as in Study 1, now focusing in getting one's favorite job or position.

Depletion manipulation We used a writing task that has been successfully used to deplete participants (Pocheptsova et al. 2009; Schmeichel et al. 2010). We asked all participants to write a story about a recent trip they had taken. Whereas participants in the non-depleted conditions did not receive any additional instructions, those in the depleted conditions were instructed not to use the letters *a* or *n*. We

asked participants to write until the program automatically switched to the next screen, which occurred 6 min after the instructions were presented.

Manipulation check: depletion manipulation To check whether participants in the depleted (vs. non-depleted) conditions indeed perceived their writing as more depleting we used four items ("How effortful was it writing about your trip?", "How tiring was it writing about your trip?", "How much did you concentrate while writing about your trip?"). Previous studies have successfully used similar items as a depletion manipulation check (Baumeister et al. 1998; Dvorak and Simons 2009; Finkel and Campbell 2001; Schmeichel et al. 2010). The 7-point scales ranged from 1 (*not at all*) to 7 (*very*). Because reliability of the scale was low ($\alpha = .41$), we dropped one item ("How much did you have to control your writing while writing about your trip?"). Dropping the item improved reliability to be acceptable ($\alpha = .64$).

Task presentation and assessment of self-regulatory thought To assess whether participants mentally contrasted, we asked them to freely write about their wish and content analyzed their written elaborations (Sevincer and Oettingen 2013). As in Study 1, we embedded the manipulation (task presentation: no task vs. task) in the instructions. In the no-task conditions participants received the same instructions as in the no-prime conditions in Study 1, now with regard to getting their favorite job or position. In the task conditions we added the following clause in bold type: "Important: After writing about getting your favorite job, you will perform a tutorial. The tutorial helps you to increase your professional competence—you will learn skills related to acquiring a new job or getting a promotion."

We assessed self-regulatory thought by the same procedure as in Study 1. Interrater agreement for the segmentation of the elaborations into statements was 90 %. As in Study 1, if the raters disagreed, we took the larger sequence. Of the 248 students, three (1 %) listed only keywords. For the coding of the statements into categories agreement was 88 % ($\kappa = .82$). Regarding the total number of statements on which raters disagreed on the coding, for 43 % an agreement could be reached through discussion between the two raters. For the remaining 57 % agreement could not be reached. If agreement could not be reached, the respective statement was coded into the category "other".

Manipulation check: task presentation To test whether participants in the task presentation conditions indeed noticed the additional clause we asked: "Did you notice the hint about a tutorial to train your professional competence on the previous page?" Participants answered either "yes" or "no".

Control variable: sad mood Participants completed the Positive and Negative Affect Scale (PANAS; Watson et al. 1988). This scale consists of 20 emotion adjectives. To obtain an indicator of sad mood, we combined the items "upset" and "distressed" ($\alpha = .76$, $r = .62$, $p < .001$). To conclude, participants answered a short demographic questionnaire, were thanked, and fully debriefed.

Results

Descriptive analyses

As in Study 1, participants' mean expectations ($M = 4.35$, $SD = 1.90$) and the incentive value of their wish ($M = 5.22$, $SD = 1.59$) were above the midpoint of the 7-point scale, indicating that they named wishes that deemed feasible and were important to them. Expectations and incentive correlated positively, $r = .66$, $p < .001$. Across conditions, 47 participants (19 %) mentally contrasted, 119 (48 %) indulged, 27 (11 %) dwelled, and 36 (15 %) reverse contrasted. Nineteen participants (8 %) generated only statements categorized as "other".

Manipulation check: depletion

Participants in the controlled writing condition ($M = 6.01$, $SD = 1.05$) perceived their writing as more depleting than those in the free writing condition ($M = 4.08$, $SD = 1.14$), $t(246) = 13.94$, $p < .001$, indicating that the manipulation was successful.

Manipulation check: task presentation

In response to the question whether they had noticed the hint about the tutorial, 21 participants (15 %) in the task presentation conditions responded with "no". These participants were excluded from the following analyses.

Self-regulatory thought

Table 2 depicts the number and percentages of the four modes of thought in each condition. Because very few participants generated only statements from the category "other" (8 %), we omitted these participants from all following analyses.

Effect of depletion on self-regulatory thought First, we tested whether depleted (vs. non-depleted) participants were less likely to mentally contrast. We conducted multinomial regression analyses with the categorical self-

Table 2 Study 2: achievement wish

Condition	N/n	Self-regulatory thought				
		Mental contrasting	Indulging	Dwelling	Reverse contrasting	Other
Non-depleted/no task	51	9 (18)	29 (57)	4 (8)	6 (12)	3 (6)
Depleted/no task	56	2 (4)	36 (64)	4 (7)	10 (18)	4 (7)
Non-depleted/task	61	18 (30)	19 (31)	9 (15)	11 (18)	4 (7)
Depleted/task	59	16 (27)	26 (44)	6 (10)	7 (12)	4 (7)

Number of participants engaging in the different modes of thought in each condition

Percentages in parenthesis

regulatory thought variable (mental contrasting, indulging, dwelling, reverse contrasting) as dependent variable and depletion (non-depleted vs. depleted) as factor using only the non-depleted/no-action condition and the depleted/no-action condition. The reference category was mental contrasting.

The overall model was marginally significant, $\chi^2(3) = 6.42$, $p = .09$, $R^2 = .07$ (Nagelkerke), indicating that depletion tended to predict self-regulatory thought. Compared to non-depleted participants, depleted participants were less likely to mentally contrast than to indulge, $b = -1.72$, $\chi^2(1) = 4.40$, $p = .04$, and to reverse contrast, $b = -2.02$, $\chi^2(1) = 4.63$, $p = .03$. There was no difference between the non-depleted and the depleted participants in their use of mental contrasting compared to dwelling, $b = -1.50$, $\chi^2(1) = 2.04$, $p = .22$. Because dwelling was the least frequent mode of thought (11 %), the latter finding that dwelling participants did not differ from mental contrasting participants may be due to low power.

Therefore, as in Study 1, to test whether depleted participants were less likely to use mental contrasting versus the three other modes of thought combined, we dummy-coded the categorical self-regulatory thought variable into mental contrasting (0) versus non-mental contrasting (1; indulging, dwelling, reverse contrasting combined). As predicted, and as in Study 1, the depleted (vs. non-depleted) participants were less likely to use mental contrasting than the other modes of thought, $b = -1.75$, $\chi^2(1) = 4.67$, $p = .03$ (overall model: $\chi^2(1) = 6.02$, $p = .01$, $R^2 = .12$; Nagelkerke).

Task presentation in depleted and non-depleted participants Second, we tested whether confronting participants with a task relevant for getting their favorite job—performing a tutorial to train professional skills—would counteract the depletion effect on the reduced use of mental contrasting. As in Study 1, to test the hypothesized interaction effect of depletion and task presentation on the use of mental contrasting, we conducted multinomial regression analyses with the categorical self-regulatory thought variable (mental contrasting, indulging, dwelling, reverse contrasting) as dependent variable, and depletion (non-deleted vs. depleted), task presentation (no task vs. task) as well as the interaction between the two factors as independent variables. The reference category was mental contrasting.

The overall model was significant, $\chi^2(9) = 26.69$, $p = .002$, $R^2 = .13$ (Nagelkerke), indicating that depletion interacted with task presentation in predicting self-regulatory thought. Specifically, depletion interacted with task presentation in predicting whether participants mentally contrasted or reverse contrasted, $b = -2.35$, $\chi^2(1) = 4.49$, $p = .03$. The depletion by task presentation interaction effect in predicting mental contrasting versus indulging, $b = -1.29$, $\chi^2(1) = 1.88$, $p = .17$, and mental contrasting versus dwelling, $b = -1.79$, $\chi^2(1) = 2.13$, $p = .14$, however missed statistical significance.

When however, as in Study 1, we repeated the above analyses with the dummy-coded mental contrasting variable (mental contrasting vs. non-mental contrasting) as dependent variable we observed a marginally significant depletion by task presentation interaction effect, $b = -1.64$, $\chi^2(1) = 3.26$, $p = .07$, indicating that, as predicted, anticipating a goal-relevant task tended to increase the number of mentally contrasting participants more for the depleted than the non-depleted participants.

Control variables

Expectations and incentive value Multinomial regression analyses with the dummy coded mental contrasting variable (mental contrasting vs. non-mental contrasting) as dependent variable and the continuous expectation measure as independent variable revealed that low (vs. high) expectations predicted more mental contrasting, $b = .19$, $\chi^2(1) = 4.32$, $p = .04$. This pattern stands in contrast to the finding in Study 1 that high (vs. low) expectations predicted more mental contrasting. Note however, that the pattern in Study 1 was most likely due to the high number of dwelling participants, who had substantially lower expectations than the other participants. In Study 2 in contrast, the most frequent mode of thought was indulging (48 %) and indulging participants had higher expectations

($M = 4.75$, $SD = 1.85$) than the other participants ($M = 4.04$, $SD = 1.82$; dwelling, reverse contrasting, and mental contrasting combined), $t(210) = 2.80$, $p = .006$. Therefore, the finding in Study 2 that low expectations predicted more mental contrasting is likely due to the high number of indulging participants having particularly high expectations. Thus, in sum the seemingly conflicting findings that in Study 1 high expectations predicted more mental contrasting and in Study 2 low expectations predicted more mental contrasting may both be due to the low versus high expectations of the dwelling and indulging participants. Analogous analyses for incentive value revealed that incentive value did not predict mental contrasting, $b = .14$, $\chi^2(1) = 1.73$, $p = .19$.

As in Study 1, we tested whether our results remained significant when controlling for differences in expectations and incentive value. Our finding that the depleted (vs. non-depleted) participants were less likely to mentally contrast (vs. not) remained significant over and above expectations, $b = -1.69$, $\chi^2(1) = 4.28$, $p = .04$, and incentive value, $b = -1.92$, $\chi^2(1) = 5.21$, $p = .02$. Similarly, the depletion by task presentation interaction in predicting mental contrasting (vs. not) remained marginally significant when controlling for expectations, $b = -1.71$, $\chi^2(1) = 3.47$, $p = .06$, and incentive value, $b = -1.69$, $\chi^2(1) = 3.42$, $p = .06$.

Sad mood We conducted analogous analyses for sad mood. In line with Kappes et al. (2011), sad mood tended to predict mental contrasting (vs. not), $b = -.41$, $\chi^2(1) = 2.82$, $p = .09$. Moreover, depletion continued to predict a reduced use of mental contrasting (vs. not) over and above sad mood, $b = -1.73$, $\chi^2(1) = 4.56$, $p = .03$. Finally, the depletion by task presentation interaction effect in predicting mental contrasting (vs. not) remained marginally significant over and above sad mood, $b = -1.67$, $\chi^2(1) = 3.34$, $p = .07$.

Number of statements generated Finally, as in Study 1, a higher (vs. lower) number of statements predicted mental contrasting (vs. not), $b = -11$, $\chi^2(1) = 5.99$, $p = .01$. Moreover, depletion continued to predict a reduced use of mental contrasting (vs. not) over and above the number of statements, $b = -1.76$, $\chi^2(1) = 4.66$, $p = .03$. Finally, the depletion by task presentation interaction effect in predicting mental contrasting remained marginally significant over and above the number of statements, $b = -1.61$, $\chi^2(1) = 3.05$, $p = .08$.

Discussion

Study 2 replicated the pattern of Study 1: Participants who exerted self-control in a controlled writing task were less likely to mentally contrast about getting their favorite job than those who had not to control their writing. A manipulation check confirmed that participants in the depleted conditions experienced their writing as more depleting than those in the non-depleted conditions. Confronting participants with a task (completing a tutorial to gain professional skills) relevant for realizing their wish to get their favorite job or position increased the number of mentally contrasting participants more for the depleted than the non-depleted participants and thus eliminated the difference in the use of mental contrasting between the two groups. Apparently, anticipating a goal-relevant task led participants to engage in mental contrasting even though they were depleted. The pattern is unlikely due to differences in participants' expectations, the incentive value of their wish, their sad mood, or the number of statements they generated as the pattern did not change when controlling for these variables.

When comparing the depletion effect on the use of mental contrasting versus each of the other modes of thought (indulging, dwelling, reverse contrasting), in both studies depleted participants were less likely to use mental contrasting as compared to indulging. However, in Study 1, depletion lead to less mental contrasting as compared to indulging and dwelling while reverse contrasting was not significant. In Study 2 depletion lead to less mental contrasting as compared to indulging and reverse contrasting while dwelling was not significant. As noted above, the finding that there was no significant difference between mental contrasting and reverse contrasting (Study 1) and mental contrasting and dwelling (Study 2) should be a consequence of the low number of reverse contrasting and dwelling, respectively, participants: The results of Studies 1 and 2 considered together indicate that depletion predicted mental contrasting as compared to each single other mode of thought, indulging, dwelling, and reverse contrasting.

General discussion

Participants who exerted self-control in a depleting task were less likely to subsequently mentally contrast than those who did not exert self-control. This pattern held true for different depleting tasks, a thought suppression task (Study 1) and a controlled writing task (Study 2), for wishes from the interpersonal (Study 1) and achievement domain (Study 2), when participants self-generated a wish (Study 1), or were presented with a wish (Study 2), with German (Study 1) and American (Study 2) participants, and with a student sample (Study 1) and a more heterogeneous sample of internet users (Study 2). Our work examined how two self-regulation theories, mental contrasting (fantasy-realization theory; Oettingen 2000, 2012) and the strength model of self-control (Baumeister et al.

1998; Muraven and Baumeister 2000) relate to each other. In addition, we investigated the role of context in counteracting the depletion effect on the use of mental contrasting. Priming the future and reality (Study 1) and confronting participants with a goal-relevant task (Study 2) reversed the effect of depletion on the reduced use of mental contrasting and increased the use of mental contrasting for both, the non-depleted and the depleted participants. The pattern did not support a number of alternative explanations: That the results were due to variations in expectations of success, incentive value of the wish, subjective self-control skills, beliefs about the limits of self-control, sad mood, and the number of statements generated.

Implications for mental contrasting

Spontaneous use of mental contrasting in everyday life

Our findings add to previous findings that people tend to spontaneously indulge or dwell rather than mentally contrast (Sevincer and Oettingen 2013). Specifically, our finding that depletion reduces the use of mental contrasting supports the idea that using mental contrasting requires mental effort. Because people's capacity to exert effort may be limited and because people are motivated to conserve their effort (Brehm and Self 1989; Silvestrini and Gendolla 2013), it is functional to engage in indulging and dwelling unless one is in a situation that calls for mental contrasting. That is, for example, when one approaches a task that is related to realizing a personally important wish.

Predicting mental contrasting

The research also adds to work exploring when people use mental contrasting. For example, using a paradigm in which mental contrasting was measured by asking participants to choose whether to elaborate aspects of the desired future and/or present reality, Kappes et al. (2011) found that participants in a sad (vs. happy or neutral) mood were more likely to mentally contrast. In line with this finding, in Study 2, sad mood tended to predict the use of mental contrasting.

Future research may investigate further factors that predict the use of mental contrasting (e.g., Sevincer et al. 2014b). For instance, because the use of mental contrasting involves mental effort and the processing of complex information, people who tend to engage in and enjoy effortful processing (those with a high need for cognition; Cacioppo et al. 1984) may be inclined to mentally contrast. Moreover, because mental contrasting is an effective self-regulation strategy promoting change rather than stability people who are concerned with improving their current state (those high in promotion focus; Higgins 1997) may use mental contrasting.

Priming mental contrasting

Our finding in Study 1 that priming future and reality increased the use of mental contrasting suggests that mental contrasting can be primed by alluding to the desired future and present reality in participants' instructions. Future research may investigate whether mental contrasting can also be primed by presenting words related to the future and reality subliminally, outside of conscious awareness (Bargh and Chartrand 2000).

Mental contrasting interventions

The results have implications for interventions aimed at teaching mental contrasting. First, our finding that environmental cues (e.g., priming future and reality) may help people to override their tendency to indulge or dwell supports the idea that the spontaneous use of mental contrasting in everyday life can be promoted by using simple tools that provide people with such cues, for example apps or diaries (http://www.woopmylife.org/). Moreover, teachers and tutors may caution people that in a depleted state the use of mental contrasting may be particularly rare. At the same time tutors may emphasize the importance of mentally contrasting in a depleted or fatigued state because then it is especially important to wisely decide how to invest one's diminished resources.

Implications for the strength model

In its original formulation, the strength model of self-control employed a metaphor of limited resources to describe the phenomenon that after exerting self-control subsequent acts of self-control are prone to failure (Baumeister et al. 1998; Muraven and Baumeister 2000). Emerging findings that under certain conditions people are able to exert self-control even though they just had depleted their resources (Alberts, et al. 2011; Baumeister et al. 2007; Job et al. 2010; Moller et al. 2006; Muraven and Slessareva 2003; Muraven et al. 2008; Schmeichel and Vohs 2009; Wan and Sternthal 2008; Webb and Sheeran 2003), however, lead to the formulation of alternative models and the revision of the original model. For example, according to the mechanistic account of self-control (Inzlicht and Schmeichel 2012; Inzlicht et al. 2014) after engaging in cognitively demanding self-control for the pursuit of "have-to" goals, people mechanistically shift their priority to engaging in cognitive leisure and the pursuit of "want-to" goals.

Our finding that depletion effects on self-regulation can be overcome by primes that facilitate mental contrasting supports alternative versions of the strength model as it seems unlikely that people's capacity for self-control is impaired (as suggested by a limited-resource account of self-control) if the presentation of simple primes is sufficient to cancel the depletion effect. Future research may explore whether priming concepts that trigger other forms of active self-regulation (e.g., forming implementation intentions, Gollwitzer 1999; emotion regulation, Gross 2007) may also alleviate possible depletion effects on the use of respective self-regulation procedures.

Frequency of other modes of thought

Reverse contrasting

Because people predominantly indulge and dwell (Sevincer and Oettingen 2013) reverse contrasting may require overriding predominant responses, just as mental contrasting does. In the present research however, depletion reduced the use of mental contrasting but did not affect the use of reverse contrasting (Tables 1, 2). This pattern supports the idea that mental contrasting and reverse contrasting involve different processes (Oettingen et al. 2001) and is in line with previous findings that mental contrasting as opposed to reverse contrasting causes deeper processing of information and modulates the strength of implicit associations (Kappes and Oettingen 2014; Kappes et al. 2012a, b). Thus, mental contrasting but not reverse contrasting is a purposeful self-regulation strategy that requires overriding predominant modes of thought.

Indulging and dwelling

When inspecting the proportion of indulging and dwelling between the control conditions in Study 1 and Study 2 (non-depleted/no-prime condition and non-depleted/no-task condition, respectively), in Study 1 dwelling (43 %) is most frequent and indulging (with reverse contrasting, each 16 %) least. Study 2 shows the opposite pattern; Indulging (57 %) is most frequent and dwelling (8 %) least. In Study 1, participants self-generated wishes from the interpersonal domain whereas in Study 2, they were presented with a wish from the achievement domain. The interpersonal wishes participants generated in Study 1 (e.g., "resolving a family conflict") focused on problems that did not readily inspire thoughts about a rosy future and often were geared to re-establishing the status quo; to the contrary, the achievement wish participants were presented in Study 2 (getting their favorite job) was clearly directed towards attaining an improvement of the status quo. Indeed, the findings are consistent with previous research on the use of mental contrasting: The high number of dwelling participants in Study 1 (43 %) concurs with a previous study, in which participants also self-generated an interpersonal wish (32 % dwelling participants; Sevincer and Oettingen 2013, Study 1, no-prime condition); the high number of indulging participants in Study 2 (57 %) concurs with a previous study, in which participants were presented with a similar achievement-related wish (being admitted to their favorite graduate school; 51 % indulging participants; Sevincer and Oettingen 2013, Study 3).

Conclusion

We hypothesized that because the use of mental contrasting involves mental effort, depleted (vs. non-depleted) people should be less likely to mentally contrast. In two studies we found support for our hypothesis and, moreover, explored how to counteract the depletion effect on the reduced use of mental contrasting. Specifically, activating the desired future and reality in people's minds by priming or increasing the demand to use mental contrasting by presenting people with an impending, goal-relevant task counteracted the effect. The findings extend research on the strength model of self-control by revealing conditions that counteract the effect of depletion on self-regulation; they extend research on mental contrasting by showing how contextual factors (depletion, priming, and an impending task) influence the use of mental contrasting.

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