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Ego Depletion and Positive Illusions: Does the Construction of Positivity Require Regulatory Resources?

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Individuals frequently exhibit positive illusions about their own abilities, their possibilities to control their environment, and future expectations. The authors propose that positive illusions require resources of self-control, which is considered to be a limited resource similar to energy or strength. Five studies revealed that people with depleted self-regulatory resources indeed exhibited a less-optimistic sense of their own abilities (Study 1), a lower sense of subjective control (Study 2), and less-optimistic expectations about their future (Study 3). Two further studies shed light on the underlying psychological process: Ego-depleted (compared to nondepleted) individuals generated/retrieved less positive self-relevant attributes (Studies 4 and 5) and reported a lower sense of general self-efficacy (Study 5), which both partially mediated the impact of ego depletion on positive self-views (Study 5).

Keywords: *positive illusions; ego depletion; regulatory resources; self-efficacy; self-regulation*

The processing of self-relevant information often is biased to serve the self, resulting in optimistic illusions concerning one's own abilities and personality, controllability of the external environment, and expectations about the future (cf. Taylor & Brown, 1988). In the present study, we argue that optimistic illusions can require considerable amounts of regulatory resources to emerge (e.g., by activities such as defending own standpoints, biased memory encoding and retrieval, suppression of threatening information, critical testing and devaluation of self-inconsistent evidence). Recent studies

have shown that regulatory resources are a limited resource similar to energy (Baumeister & Heatherton, 1996; Heatherton & Baumeister, 1996; for an overview, see Muraven & Baumeister, 2000) and can be depleted by various regulatory activities, such as the control of thoughts, emotions, and behaviors, which are required for decision making, self-presentation, or intellectual performance (e.g., Schmeichel, Vohs, & Baumeister, 2003; Vohs, Baumeister, & Ciarocco, 2005; Vohs, Baumeister, & Tice, 2006). When this resource is depleted, self-functioning is reduced as well. In this context, the aim of the present research is to examine whether the active self is necessary to construct positive illusions. More precisely, we aimed to demonstrate that ego-depleted (compared to nondepleted) individuals exhibit lower degrees of optimism (positive illusions) concerning their own abilities (Study 1), subjective sense of control (Study 2), and optimistic future expectations (Study 3). Moreover, we have attempted to clarify the underlying psychological processes (Studies 4 and 5) that are expected to be associated (a) with the decreased ability of ego-depleted individuals to generate and/or retrieve positive information and attributes about the self from their cognitive system and (b) an overall reduced sense of general self-efficacy.

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Positive Illusions

Individuals have been found to exhibit positive illusions about three major dimensions relevant to their self-esteem: they frequently overestimate (a) their abilities and characteristics compared with other people, (b) overestimate their personal control over their environment, and (c) have optimistic illusions about their own future (cf. Taylor & Brown, 1988). With regard to own abilities (above-average effect), most people appear to believe that they are more athletic, intelligent, attractive, and so forth, than the average person (Alicke, Klotz, Breitenbecher, Yurak, & Vredenburg, 1995; Kruger & Dunning, 1999). The exaggerated perception of control is a second important area of research on positive illusions (Taylor & Brown, 1988; see also McKenna, 1993) and addresses the phenomenon that people, for example, systematically overestimate the extent to which they cause certain outcomes (Miller & Ross, 1975; Taylor, Lerner, Sherman, Sage, & McDowell, 2003) or systematically overestimate the controllability of chance-determined situations (for a review, see Crocker, 1982). The third area of positive illusions addresses people's tendency to be too optimistic about their future life. For example, when asked about their chances of experiencing negative events, such as being a crime victim (Perloff & Fetzer, 1986), being unemployed (Weinstein, 1980), or becoming ill (Perloff & Fetzer, 1986), most people underestimated the probability of experiencing such negative events. By contrast, the probability of experiencing positive events, such as bearing gifted children (Weinstein, 1980) or having a positive future at all (Markus & Nurius, 1986), is mostly overestimated.

Researchers in this field have suggested that optimistic illusions can be based on a motivation to maintain a positive sense of self-esteem (Alicke, 1985; Brown, 1986; Chambers & Windschitl, 2004; Taylor & Brown, 1988). With regard to this explanation, people systematically report to be, for example, better workers, more athletic, or better drivers than others (e.g., Alicke et al., 1995; for a review, see Chambers & Windschitl, 2004) because they attempt to bolster their general self-concept; at the same time, such favorable self-descriptions protect one's self-concept from unfavorable frustrations, actions, or events (Alicke, 1985). Other accounts explained positive illusions and self-serving biases in terms of selective encoding, processing, or retrieval of stored knowledge (Kunda, 1990) as well as asymmetric testing processes and biased reference points (Ditto & Lopez, 1992; Ditto, Scepansky, Munro, Apanovitch, & Lockhart, 1998).

Positive Illusions: Resource-Consuming or Automatic Processes?

Most important to our arguments, we propose that positive illusions can be based on deliberate,

resource-consuming rather than automatic, passive processes. Concluded by results of former research (e.g., Ditto et al., 1998; Ditto & Lopez, 1992; Fiske & Taylor, 1984; Snyder & Swann, 1976; Taylor & Crocker, 1981; Tetlock, 1983), positive illusions are assumed to need the active self and thus expend self-regulatory resources because they can require activities such as defending own standpoints, biased memory encoding and retrieval, suppression of threatening information, or selective devaluation of self-inconsistent evidence. For example, individuals have been shown to moderate their opinions to fit them to the opinion of significant others (Snyder & Swann, 1976; Tetlock, 1983), select methods of communication that preferentially solicit self-confirming feedback (Swann, 1983), or engage filters in their cognitive system to encode, retrieve, and interpret information as being consistent with their own opinions (Fiske & Taylor, 1984; Greenwald, 1980; Taylor & Crocker, 1981). Further research has shown that ambiguous information tends to be interpreted as consistent with prior beliefs (for a review, see Taylor & Crocker, 1981), inconsistent information is scrutinized more closely than is confirmatory information (Ditto et al., 1998; Ditto & Lopez, 1992), and inconsistent information is even actively excluded or suppressed from the cognitive system (Shrauger & Schoeneman, 1979; Taylor & Brown, 1988).

With regard to processes of mental control and mental health, Freud (1915/1957) argued that individuals preserve subjective well-being by actively keeping negative thoughts out of consciousness, which can be an effortful and deliberate process. Derived from Freud's ideas, modern therapy employs techniques for controlling negative thoughts and emotions (e.g., Beck, 1976; Ellis, 1962). In addition, modern theories of affect control (e.g., Clark & Isen, 1982) proposed that individuals are able to control negative thoughts and moods directly by intentionally focusing away from negative toward positive thoughts. Accordingly, self-distraction is a frequently mentioned strategy for coping with sorrows (Rachman & de Silva, 1978).

Further support from social psychology research for the assumption that self-serving bias needs the control of the self by the self is provided by studies showing that biases in information processing and evaluation vanish when people's cognitive resources are impaired by competing cognitive load tasks (e.g., Ditto et al., 1998; Ditto & Lopez, 1992; Fischer, Jonas, Frey, & Schulz-Hardt, 2005; Schulz-Hardt, Fischer, & Frey, 2007). For example, Ditto and Lopez (1992) demonstrated that inconsistent evidence is tested more critically (and thus systematically devalued in comparison to consistent evidence), whereas this tendency is reduced under cognitive load (see also Ditto et al., 1998). In addition to this, Zadro, Williams, and Richardson (2004) yielded that

social exclusion—which was shown to consume self-regulatory resources and thus works like an ego-depletion manipulation (see Baumeister, DeWall, Ciaracco, & Twenge, 2005)—leads to a lowered instead of increased sense of control.

Although previous research was not intended to directly test whether the construction of positive illusions requires self-regulatory resources, it provides first hints that the construction of positive illusions and self-serving biases might be based on deliberate, active processes. However, there is also other research to suggest that self-serving biases increase (instead of decrease) when people's regulatory and cognitive resources are reduced. For example, research on automatic egotism by Paulhus, Graf, and Van Selst (1989) demonstrated that self-evaluation while performing another concurrent load task led to enhanced rather than decreased positive self-views, thereby suggesting that self-enhancement is a rather automatic process. Another series of studies by Fischer, Greitemeyer, and Frey (2007) found that ego-depleted participants exhibited a stronger confirmation bias in the external search for attitude- and decision-relevant information than did nondepleted individuals.¹ This effect was mainly driven by an increased commitment to the own position of ego-depleted participants. In addition, Vohs et al. (2005) found that ego-depleted participants reported higher levels of narcissism than did nondepleted participants.

Although these three lines of research did not directly investigate the classic dimensions of positive illusions suggested by Taylor and Brown (1988), which are investigated in the present research, it at least suggests that self-enhancement and self-serving processes also can be more automatic rather than deliberative and resource-consuming processes. To resolve these conflicting results, we think that self-enhancement and self-serving biases can be based on both automatic and deliberate processes, whereas only for the latter case might ego depletion impair the ability to construct positive illusions. In other words, if positive illusions are based on more complex processes, including complex defense processes, searching the memory for favorable information, suppression of self-threatening information, impaired regulatory resources will lead to reduced rather than increased positive views of the self. However, if only easy rules are required to decide whether a specific piece of information supports or contradicts the positive self-views, ego depletion might even increase self-serving tendencies. Accordingly, it is likely that the tasks in the three above-mentioned studies, which found a self-enhancement effect (Fischer et al., 2007; Paulhus et al., 1989; Vohs et al., 2005), were less resource-consuming than tasks employed to investigate the classic three dimensions of positive illusions suggested by Taylor and Brown (1988). For example, in Fischer

et al.'s (2007) studies, participants decided by way of short, main arguments as to whether they wanted to read the related article in detail. Most important, each main argument explicitly made clear whether the associated article would be consistent or inconsistent with the own standpoint; thus, it should have been relatively easy for participants to select the consistent and reject the inconsistent. Furthermore, Paulhus et al. (1989) asked participants to rate themselves on traits, which again enabled participants to follow a simple rule of embracing the positive and rejecting the negative. Similarly, in the research of Vohs et al. (2005), it also was relatively easy to respond to the narcissism scale in a self-serving manner (no complex comparisons with other fictive persons, extended memory search, or the development of future conceptions were necessary to answer questions such as, "If I ruled the world it would be a much better place" or "I am going to be a great person"; Vohs et al., 2005, p. 651). Moreover, participants in the Vohs et al. (2005) studies expected the research to be on interpersonal and/or communication processes. Thus, the increased narcissism of depleted participants in Study 8 was mediated by reduced levels of social desirability. It is likely that interpersonal contexts (as was indeed demonstrated by the authors) trigger completely different processes in terms of self-regulation and self-serving biases (or self-serving presentations, respectively) than statements about the self that are not expected to be made to another person or audience.

In summary, there is evidence that both (a) the emergence of positive illusions requires the active response of the self and (b) positive illusions are based on rather automatic processes. We propose that the occurrence of positive illusions as suggested by Taylor and Brown (1988, i.e., above-average effect, illusion of control, future optimism) requires self-regulatory processes, such as defensive information processing, suppression of threatening evidence or biased encoding, and retrieval of self-relevant information. For example, the above-average effect requires multiple and complex comparisons between attributes of the own person (with all its positive and negative attributes) and attributes of other (imagined) average individuals. Thereby, individuals also must engage in an extended memory search to determine their own positive attributes as well as suppress potential negative ones. Moreover, positive expectations about the person's own future require taking proper perspective, memory search for positively predicting personal attributes, and the development of future conceptions, whereas illusions of control need a strong sense of self-efficacy, which also can be regarded as the impression of a well-functioning self. In short, the classic three dimensions of positive illusions are likely to consume self-regulatory resources when they occur.

This assumption is further explicated and tested by the present line of research.

Self-Control, Ego Depletion, and the Construction of Positive Illusions

Self-control is defined as the exercise of control over the self by the self (e.g., Schmeichel et al., 2003). Self-control is employed when a person tries to change the way he or she would normally think, feel, or behave (Muraven & Baumeister, 2000), whereas self-control behaviors are designed to maximize the individual's long-term best interests (Barkley, 1997). With regard to the limited resource perspective, the self has only a limited amount of some resources that are similar to that of energy or strength, which can be depleted when the self overrides, changes, or regulates behavior and psychological responses (Baumeister, Bratlavsky, Muraven, & Tice, 1998; Baumeister & Heatherton, 1996; Muraven & Baumeister, 2000; Schmeichel et al., 2003; Vohs et al., 2005; Vohs et al., 2006). This self-regulation resource can be used for several different tasks, including inhibiting impulses, controlling emotions, regulating thoughts, processing information, or dealing with frustration. On that score, self-regulation is assumed to be a general and basic resource that can affect various acts of executive functioning and self-control.

Several studies support the assumption that self-control is a limited resource by demonstrating that the preceding exertion of self-regulation resources leads to impairment of subsequent self-regulatory performance. Typically, people have been asked to show self-regulatory behavior, such as controlling their emotions or actively guiding their attention. Afterward, the performance on another self-regulatory task is measured (e.g., emotion control, task persistence, intellectual behavior), with the consistent result that the performance on the following self-regulatory task is impaired as a consequence of the prior self-regulatory task (e.g., Baumeister et al., 1998; Muraven, Tice, & Baumeister, 1998; Schmeichel et al., 2003; Vohs et al., 2005). A variety of recent studies suggest that the limited resource of self-regulation is involved in different activities that are not directly related to self-control, for example, intellectual performance, decision making, impression management and self-presentation, as well as active responding (Baumeister et al., 1998; Baumeister, Twenge, & Nuss, 2002; Schmeichel et al., 2003; Vohs et al., 2005; Vohs & Faber, in press). Based on the above-mentioned line of argumentation, we propose that the emergence of positive illusions and positive self-views is based on complex defense processes and thus requires self-regulatory resources as well.

THE PRESENT RESEARCH

The present research involved five studies that were designed to test our hypothesis that ego depletion manipulated by a prior self-control task reduces the construction of positive illusions. Across all five studies, ego depletion was first manipulated by having participants either perform tasks that demanded self-regulation (e.g., thought suppression, emotion control) or perform alternative tasks that were assumed to demand less self-regulatory resources. Afterward, following the optimism-related threefold distinction of Taylor and Brown (1988), as dependent variables, we measured (a) comparative self-reported abilities (above-average effect; Study 1), (b) subjectively experienced controllability of a chance-determined event (illusion of control; Study 2), and (c) optimism in future expectations (future optimism; Study 3). The expected mechanisms—a decreased ability of ego-depleted individuals to generate/retrieve positive self-relevant information and a reduced sense of general self-efficacy—were tested in Studies 4 and 5.

STUDY 1

Most of us appear to believe that we are more intelligent, organized, attractive, and so forth, than the average person (Alicke et al., 1995; Chambers & Windschitl, 2004; Kruger & Dunning, 1999). Because self-representations are affectively very important to the self (Prentice, 1990), this phenomenon has traditionally been interpreted as evidence of an important need to boost the self-esteem (e.g., Taylor & Brown, 1988). Because self-presentations are such central concepts, individuals are supposed to engage in resource-consuming defensive processes (e.g., suppressing negative and highlighting positive self-relevant attributes) when they compare their skills, attributes, and abilities with those of other people. In addition, the above-average effect requires complex comparison processes concerning oneself and imagined average peers. Hence, we postulate that ego-depleted individuals are less able to favorably compare themselves with peers on important self-relevant dimensions compared to non-depleted individuals.

Method

Participants and design. One hundred students (72 women, 28 men; 18-45 years of age; $M = 23.55$, $SD = 3.80$) from Ludwig-Maximilians-University, Munich, participated in this experiment. It was based on a 2 (ego depletion: low vs. high) \times 2 (type of depletion manipulation: cognitive vs. affective) \times 4 (above-average dimension:

TABLE 1: Means of the Experimental Conditions in Study 1

	<i>Experimental Condition</i>			
	<i>Low Depletion</i>	<i>High Depletion</i>	<i>F^a</i>	<i>η²</i>
Intelligence	7.08 (1.32)	6.52 (1.34)	4.35*	.05
Ability to learn	6.76 (1.49)	6.10 (1.45)	4.97*	.05
Memory	7.08 (1.50)	6.20 (1.63)	8.12*	.08
Work organization	6.82 (1.60)	6.08 (2.13)	3.83*	.04

a. Univariate follow-up ANOVAs; $df = 1, 96$.

* $p < .05$.

intelligence vs. ability to learn vs. memory vs. work organization) multivariate factorial design.

Material and procedure. After participants arrived individually at the laboratory, they were first asked to watch a short videotape. To increase ecological validity (multi-method perspective), we employed both cognitive and affective manipulations of ego depletion. The cognitive ego-depletion manipulation (attention control) was similar to the type of manipulation used by Gilbert, Krull, and Pelham (1988) and Schmeichel et al. (2003). Participants were asked to watch a 5-min videotape without audio that featured the former German minister of foreign affairs being interviewed. Participants were informed that the experiment addressed nonverbal assessments of personality characteristics and self-perception; thus, they would be later making person-perception judgments of the interviewed minister as well as reporting on individual characteristics of this person. Beyond the minister being interviewed, the tape contained a series of well-known, one-syllable words (e.g., *car*, *flower*) appearing at the bottom third of the screen. Each word was shown for about 10 s and was printed in white letters on a black background. These words had no relationship to the minister being interviewed or the content of the interview in progress. The depletion manipulation was carried out as follows. In the low-depletion condition, participants were given no instructions concerning the irrelevant words on the bottom of the screen and were not made aware of the words prior to viewing the video. By contrast, in the high-depletion condition, participants were instructed not to read or look at any words that may appear on the bottom of the screen. In addition, participants in the high-depletion condition were told to redirect their gaze to the minister being interviewed whenever they found themselves becoming aware of the words on the bottom of the screen.

With regard to the emotional depletion condition (emotion control), participants were informed that the present study was investigating the association between

experiencing emotions and self-perception. Therefore, the first part of the investigation involved watching a funny cartoon movie, whereas the second part involved remembering individual characteristics. In the high-depletion condition, participants were instructed to try not to show or feel any emotions while they watched the movie (suppress emotions condition). To ensure that participants followed this instruction, the experimenter said that they would be videotaped while watching the funny film (which actually was only bogus feedback). By contrast, in the low-depletion condition, participants were instructed to let their emotions flow while watching the movie, without any attempt to hide or suppress these feelings. In addition, they also were told that their reaction would be videotaped. Following these instructions, all participants watched a 5-min clip from the U.S. cartoon series “The Simpsons.”

After being exposed to either the cognitive or affective depletion manipulation, participants reported on four ability dimensions on a scale from 0 (*definitely worse*) to 10 (*definitely better*) to what extent they compare themselves with the average person. These dimensions included “intelligence,” “ability to learn new things,” “memory,” and “work organization” and were similar to those used by previous authors (cf. Chambers & Windschitl, 2004; Kruger & Dunning, 1999). Finally, participants were debriefed, thanked for their participation, and dismissed.

Results and Discussion

Means and standard deviations are given in Table 1. A 2 (ego depletion) \times 2 (type of depletion manipulation) \times 4 (above-average dimension) multivariate analysis of variance (MANOVA) revealed a significant main effect for ego depletion, $F(4, 93) = 2.88, p = .03, \eta^2 = .11$. Univariate follow-up analyses revealed that participants in the low-depletion condition reported a stronger above-average effect for intelligence, ability to learn, memory, and work organization than did participants in the high-depletion

condition. Furthermore, the main effect for the ego-depletion manipulation was qualified by a marginal interaction between ego depletion and type of depletion manipulation, $F(4, 93) = 2.32, p = .06, \eta^2 = .09$, indicating that the effect of emotional manipulation of ego depletion was stronger than the effect of cognitive manipulation. No further significant effects were obtained, all $F_s < 1$.

In summary, Study 1 revealed that participants with low self-regulation resources were more realistic in assessing their abilities in relation to others compared to participants with high self-regulation resources. In other words, high self-regulation resources were associated with a stronger above-average effect than low self-regulation resources. Please note that optimistic illusions were not fully eliminated by the ego-depletion manipulation.

STUDY 2

As mentioned in the introduction, researchers consistently found that peoples' beliefs in personal control often are greater than can be justified. For example, they overestimate the probability that they were the cause of certain outcomes (Miller & Ross, 1975) or overestimate the controllability of chance-determined situations (for a review, see Crocker, 1982). As in Study 1 for the above-average effect, we assumed that positive illusions that concern the construction and overestimation of personal control are maintained by an active process that requires resources of self-regulation. This proposition is supported by findings that the overestimation of controllability (illusion of control; Harris & Middleton, 1994; McKenna, 1993) is especially strong among individuals with high internal locus of control (who believe that they are actively capable of controlling the occurrence of events; Hoorens & Buunk, 1993), which implies that self-control or the perception of self-control, respectively, may be involved in the occurrence of exaggerated controllability. More directly, research by Zadro et al. (2004) yielded that social exclusion (which also was shown to consume self-regulatory resources and thus work like an ego-depletion manipulation; see DeWall & Baumeister, 2006) leads to a lowered sense of control. Derived from this line of thought, in Study 2, we investigated whether ego depletion impairs the experienced sense of control. As in Study 1, participants were or were not ego depleted and subsequently reported their experienced controllability of winning a dice gamble (which was indeed fully determined by chance).

Method

Participants and design. Ninety-seven students (72 women, 25 men; 18-63 years of age; $M = 25.33$

$SD = 10.04$) from Ludwig-Maximilians-University, Munich, participated in this experiment. It was based on a 2 (ego depletion: low vs. high) \times 2 (type of depletion manipulation: cognitive vs. affective) factorial design.

Material and procedure. As in Study 1, to increase ecological validity, participants' self-regulation resources were manipulated by either an affective or cognitive depletion procedure. The procedure, material, and cover story were the same as in Study 1, with the exception that the measurement of the dependent variable was framed as a second, unrelated experiment, which was a pretest for another study to be conducted in the future. Subsequent to the depletion manipulation, participants were informed that the second study addressed gambling behavior. The participants were informed that they could throw a die. When the result was lower than 4, participants would receive a double experimental credit (0.5 + 0.5 hours). However, if the result was 4 to 6, participants would receive no experimental credit at all. Before they threw the die, participants were asked to what extent (0 = *extremely low*, 10 = *extremely high*) they were confident that they would win the game. At the conclusion of the experiment, all participants received a 1-hour experimental credit regardless of the result of the gamble. Subsequently, participants were debriefed, thanked for their participation, and dismissed.

Results and Discussion

A 2 (ego depletion) \times 2 (depletion manipulation) analysis of variance (ANOVA) revealed a significant main effect for the ego-depletion manipulation, $F(1, 93) = 5.15, p = .03, \eta^2 = .05$, indicating that participants with high resources of self-regulation ($M = 3.70, SD = 1.14$) were more confident that they would win the game than were participants with low resources of self-regulation ($M = 3.24, SD = 0.94$). No further significant effects occurred, all $F_s < 1$.

To summarize, participants with high resources of self-regulation (low ego depletion) reported higher levels of subjectively experienced control over a fully chance-determined situation than did participants with low resources of self-regulation (high ego depletion).

STUDY 3

The third area of Taylor and Brown's (1988) research on positive illusions addresses people's tendency to exhibit positive illusions about their future life;

that is, people overestimate their probability of experiencing positive future events and, in contrast, underestimate their probability of experiencing negative events in the future. In line with the previous two studies, we argued that the construction of an optimistic view about one's own future also requires considerable amounts of self-regulation because to see a positive future for oneself requires (a) perspective taking (they must imagine themselves in the future), (b) retrieval of positive self-attributes from memory and application to predict a positive future status quo, and (c) suppression of negative attributes during this memory search. We assume that these processes are resource-consuming activities and thus reduce the available self-regulatory resources. This line of reasoning was tested in a straightforward manner in the next experiment.

Method

Participants and design. Fifty-six participants (34 women, 22 men; 16-47 years of age; $M = 23.84$, $SD = 4.92$) from Ludwig-Maximilians-University, Munich, participated in this experiment. It was based on a 2 (ego depletion: low vs. high) \times 2 (type of future event: positive vs. negative) factorial design with repeated measures on the last factor.

Material and procedure. An alternative manipulation of ego depletion was carried out (for a similar but partially different manipulation, see Baumeister et al., 1998): Participants were asked to participate in a study on concentration, mood, and personality. After signing an informative consent form, the ego-depletion manipulation was conducted. Each participant was given a typewritten sheet of paper with meaningless text (a page from a statistics book) and was told to cross off all occurrences of the letter *e*. For the participants assigned to the high ego-depletion condition, the task was designed to be very difficult, requiring them to consider and follow multiple rules and to control their decisions permanently. They were told that they should only cross off an *e* if it did not occur next to another vowel or one letter away from another vowel (thus, one would not cross the *e* in *Peter*). Also, the photocopy of the stimulus page had been lightened, making it relatively more difficult to read and thus requiring additional attention. In contrast, participants in the nondepletion condition were given a high-quality photocopy with good contrast and were instructed to cross every single *e* with no further rules or restrictions.

After the depletion manipulation (which lasted about 10 to 15 min), to rule out alternative explanations based on mood differences, participants' positive and negative emotions were measured with the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988).

Next, participants reported on a scale from 0 (*very unlikely*) to 10 (*very likely*) the subjective probabilities that (a) in the future, their most important wishes would be realized and (b) in the future, they will suffer from a severe disease (the content of both items was derived from previous research on future optimism; cf. Perloff & Fetzer, 1986, for the illness item; Markus & Nurius, 1986, for the item on overall future optimism). At the completion of the experiment, participants were informed about the real aim of the investigation and were dismissed.

Results and Discussion

Check for interfering effects. The ego-depletion manipulation had no effect on reported positive and negative affect, all $F_s < 1.83$, all $p_s > .18$. All of the following results remained constant when positive and negative affect was controlled for in an ANCOVA.

Future optimism. A 2 (ego depletion) \times 2 (type of future event: positive vs. negative) ANOVA with repeated measures on the second factor revealed a significant interaction between ego depletion and type of future event, $F(1, 54) = 9.05$, $p < .01$, $\eta^2 = .14$. Univariate follow-up analyses, conducted separately for positive and negative future events, indicated that ego-depleted participants ($M = 4.07$, $SD = 2.99$) were less optimistic about realizing their most important wishes than were nondepleted participants ($M = 5.76$, $SD = 2.63$), $F(1, 54) = 5.04$, $p = .03$, $\eta^2 = .09$. Moreover, ego-depleted participants ($M = 5.07$, $SD = 1.75$) reported higher probabilities concerning their future vulnerability to a severe disease than did nondepleted participants ($M = 3.97$, $SD = 1.76$), $F(1, 54) = 5.56$, $p = .02$, $\eta^2 = .09$ (see Figure 1).

To summarize, participants in the high ego-depletion condition were less optimistic about their future than nondepleted participants. Please note that compared to Study 1, a limitation of both Studies 2 and 3 is that participants indicated their sense of control (Study 2) and future optimism (Study 3) not in comparison to a reference group (i.e., other average people).

STUDY 4

In the next study, we attempted to shed first light on the underlying psychological processes involved in the impact of ego depletion on the construction of positive illusions. More specifically, we proposed that ego-depleted individuals are less able to construct positive illusions and positive views of the self because they are less able to generate or retrieve positive self-relevant information. Positive self-relevant pieces of information are supposed to be elementary ingredients for the

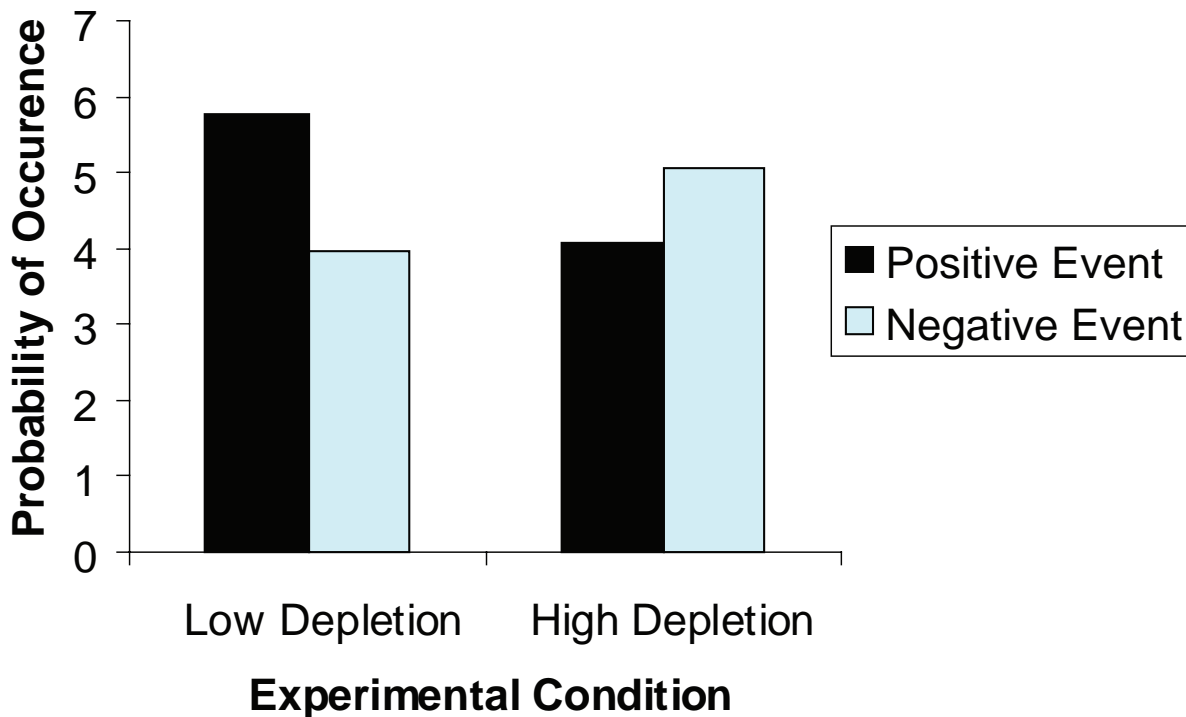


Figure 1 Probability of occurrence of positive and negative future events dependent on high and low ego depletion (Study 3).

construction of positive illusions: We know from previous research that people predominantly retrieve information consistent with their prior beliefs or theories (Fiske & Taylor, 1984; Greenwald, 1980) and, in turn, that the accessibility of positive self-relevant information is indeed positively associated with mental health (Taylor & Brown, 1988). Other research (cf. Chaiken, Giner-Sorolla, & Chen, 1996; Chaiken, Liberman, & Eagly, 1989) shows that people mostly hold favorably skewed a priori knowledge about their standpoints and opinions, which explicitly helps them to devalue inconsistent and threatening information.

In short, ego-depleted individuals are supposed to be less able to conduct an active memory search (and thus find less positive self-attributes) than nondepleted individuals. Derived from this line of argumentation, we investigated whether depleted or nondepleted resources of self-regulation differently affect the generation/retrieval of positive and negative self-relevant attributes. Hence, in Study 4, participants were or were not ego depleted and subsequently wrote down as many positive and negative self-relevant attributes about their self as they could generate or retrieve. It was expected that the difference between positive and negative attributes would be lower when people were depleted than when they were previously not depleted.

Method

Participants and design. One hundred and three students (60 women, 43 men; 18-51 years of age; $M = 31.16$, $SD = 7.30$) from Ludwig-Maximilians-University, Munich, participated in this experiment. It was based on a 2 (ego depletion: low vs. high) \times 2 (type of depletion manipulation: cognitive vs. affective) \times 2 (self-relevant attributes: positive vs. negative) factorial design with repeated measures on the last factor.

Material and procedure. Again, participants were or were not ego depleted by an affective and cognitive depletion manipulation. The cover story, material, and procedure were the same as in Study 1. Only the dependent variables were different: After the depletion manipulation, participants were asked to write down all of their positive and negative self-relevant attributes and characteristics. Participants had no time restrictions for this task. Afterward, participants were debriefed, thanked for their participation, and dismissed.

Results and Discussion

A 2 (ego depletion) \times 2 (type of manipulation) \times 2 (self-relevant attributes) ANOVA with repeated measures on

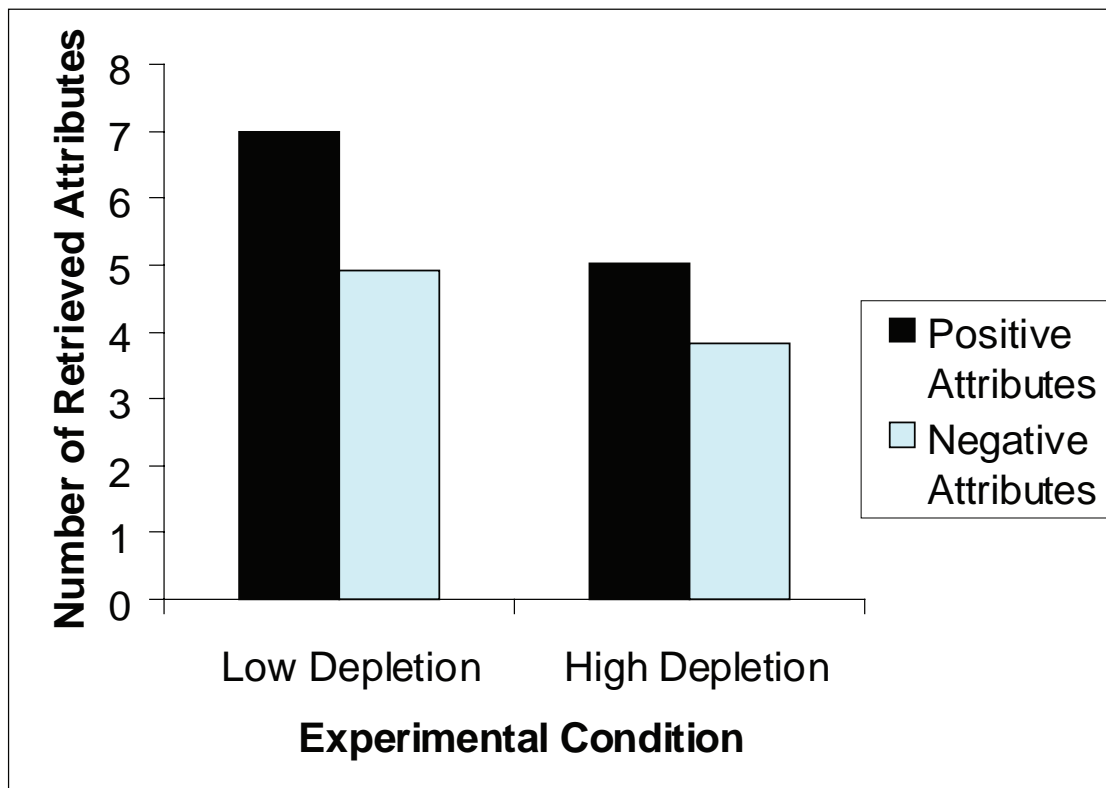


Figure 2 Retrieved positive and negative personality attributes dependent on high and low ego depletion (Study 4).

the last factor revealed a significant main effect for self-relevant attributes, $F(1, 99) = 60.64, p < .001, \eta^2 = .38$, indicating that participants retrieved more positive ($M = 5.98, SD = 3.31$) than negative attributes ($M = 4.35, SD = 2.50$). Furthermore, a significant main effect occurred for ego depletion, $F(1, 99) = 9.50, p < .01, \eta^2 = .09$, indicating that ego-depleted participants ($M = 4.42, SD = 1.82$) retrieved fewer attributes than did nondepleted participants ($M = 5.96, SD = 3.27$). Most important for our line of reasoning, the analysis of the experimental design revealed an interaction between self-relevant attributes and ego depletion, $F(1, 99) = 4.40, p = .04, \eta^2 = .04$. Follow-up analyses revealed that the difference between reported positive and negative attributes was stronger for nondepleted (positive attributes: $M = 7.00, SD = 3.77$; negative attributes: $M = 4.92, SD = 3.14$), $F(1, 49) = 40.82, p < .001, \eta^2 = .45$, than for ego-depleted participants (positive attributes: $M = 5.02, SD = 2.49$; negative attributes: $M = 3.81, SD = 1.55$), $F(1, 52) = 19.44, p < .001, \eta^2 = .27$ (see Figure 2).

In summary, Study 4 revealed that ego-depleted participants wrote down less positive attributes (or a less-favorable ratio between positive and negative

attributes, respectively) about themselves than did the nondepleted participants. A limitation of Study 4 was that we did not measure another type of potential positive illusion (e.g., future expectations or above-average effect) and so were not able to test whether the amount of generated/retrieved positive attributes indeed mediated the impact of ego depletion on positive illusions. To test this line of thought more directly, we conducted a fifth study in which we measured both the salient positive and negative self-relevant attributes as well as the strength of the above-average effect, positive future expectations, and perception of control over the environment after the ego-depletion manipulation.

STUDY 5

In the last study, we employed an alternative (more cognitive) manipulation of ego depletion—the “white bear” paradigm (cf. Muraven et al., 1998; Wegner, Schneider, Carter, & White, 1987). Participants were instructed to imagine a walk through the zoo and write down every animal they expected to see. Participants in

the high-depletion condition also were instructed not to think about a white bear. Participants in the low-depletion condition did not receive this extra instruction. Afterward, as in Study 4, participants wrote down their positive and negative self-relevant attributes, compared themselves on several self-relevant dimensions with the average person, and answered questions on future expectations as well as their subjective sense of control and self-esteem.

To further elucidate the underlying psychological processes, we also measured on a more exploratory basis participants' self-efficacy, which reflects the expectation of being able to control challenging environmental demands by means of taking adaptive action (Bandura, 1997; Schwarzer & Jerusalem, 1995; Schwarzer & Scholz, 2000). Based on this definition, we think that the subjective sense of self-efficacy may be a central component of the active, nondepleted self and thus might be an additional potential mediator for the effect of ego depletion on the reduced ability to construct positive views of the self (positive illusions).

Method

Participants and design. Thirty students (27 women, 3 men; 19-37 years of age; $M = 22.57$, $SD = 3.35$) from Ludwig-Maximilians-University, Munich, participated in this experiment. It was based on a one-factorial design with ego depletion (low vs. high) as an independent variable.

Material and procedure. First, self-regulation resources were manipulated by the white bear paradigm (Muraven et al., 1998). Participants were instructed to imagine a walk through the zoo and write down every animal that came to their mind. Ego-depleted participants also were instructed not to think about a white bear; however, whenever they do so they should suppress this thought and mark a cross in the written thought listing on their questionnaire. Participants in the low-depletion condition did not receive any such extra instruction. Next, as in Study 4, participants were asked on an open questionnaire to write down all positive and negative self-relevant attributes that came to their mind. Afterward, they answered questions concerning the above-average effect, positive future expectations, illusion of control, self-efficacy, and self-esteem, which were derived from previous research in this area (for an overview, see Taylor & Brown, 1988). Specifically, positive future expectations were measured using the following items on a scale from 0 (*not at all*) to 10 (*extremely*): (a) "In the future, I will be successful in my professional life"; (b) "In the future, I will never suffer from a severe disease"; (c) "In the future, I will

have a good career"; (d) In the future, I will not suffer any hardship"; and (e) In the future, I will have more money than other people." Because all items were highly correlated (r s ranging between .33 and .80, all p s < .08), they were collapsed onto a scale of future optimism ($\alpha = .85$). Positive views of the self concerning above-average considerations were measured by the following items on a scale from 0 (*not at all*) to 10 (*extremely*): (a) "To what extent do you think that you are more intelligent than other people?" (b) "To what extent do you think that you have a better memory than other people?" (c) "To what extent do you think that you are more attractive than other people?" (d) "To what extent do you think that you are better at mathematics than other people?" and (e) "To what extent do you think that you are more successful in your job than other people?" Because all items were highly correlated (r s ranging between .26 and .66, all p s < .08, except one correlation that was $p = .15$), they were collapsed into a scale of future optimism ($\alpha = .85$). Perceived control was measured by the following items on a scale from 0 (*not at all*) to 10 (*extremely*): (a) "I have great control over my life"; (b) "I have great control over my professional life (career)"; (c) "I have control of whether good things will happen to me"; (d) "I have control of whether bad things will happen to me"; and (e) "I am fully responsible for my own success." All items were highly correlated (r s ranging between .36 and .76, all p s < .05) and were thus collapsed onto a scale of perception of control ($\alpha = .85$). Finally, participants answered the Rosenberg (1965) Self-Esteem Scale ($\alpha = .84$) and replied to a 10-item questionnaire on general self-efficacy (Schwarzer & Jerusalem, 1995) containing 10 items on a scale from 1 (*not at all true*) to 4 (*exactly true*). Two examples of the items used are as follows: "I always manage to solve difficult problems if I try hard enough" and "Thanks to my resourcefulness, I know how to handle unforeseen situations" ($\alpha = .89$). Finally, participants completed the Rosenberg (1965) Self-Esteem Scale. At the conclusion of the experiment, participants were debriefed and thanked for participation.

Results and Discussion

Check for interfering effects. No differential impact of the ego-depletion manipulation was found on positive and negative emotions, $F < 1$. Moreover, controlling positive and negative emotions as covariates did not substantially change the direction of the results reported below.

Retrieved positive and negative self-relevant attributes. For an overview, see also Table 2. A 2 (ego depletion) \times 2 (self-relevant attributes) ANOVA with repeated measures on the last factor revealed a significant main effect

TABLE 2: Means of the Experimental Conditions in Study 5

	Experimental Condition			
	Low Depletion	High Depletion	F ^a	η ²
Above-average effect	5.17 (1.47)	4.16 (1.07)	4.50*	.14
Future optimism	5.28 (1.57)	4.24 (1.19)	4.03*	.13
Perception of control	4.83 (1.64)	4.41 (1.30)	< 1	
Self-efficacy	2.92 (0.50)	2.49 (0.47)	5.80*	.17
Self-esteem	3.37 (0.43)	3.10 (0.51)	2.49	.13
Positive attributes	7.06 (2.49)	5.21 (1.89)	5.13*	.16
Negative attributes	3.25 (1.29)	3.14 (1.17)	< 1	
Overall positive self-view	5.09 (1.18)	4.27 (0.96)	4.24*	.13

a. Univariate follow-up ANOVAs; $df = 1, 28$.

* $p < .05$.

for the number of retrieved self-relevant attributes, $F(1, 28) = 4.33$, $p < .05$, $\eta^2 = .13$, indicating that nondepleted participants ($M = 5.16$, $SD = 1.35$) overall retrieved more positive and negative self-relevant attributes than did depleted participants ($M = 4.18$, $SD = 1.20$). Furthermore, overall participants also retrieved more positive ($M = 6.20$, $SD = 2.39$) than negative attributes ($M = 3.20$, $SD = 1.22$), $F(1, 28) = 40.35$, $p < .001$, $\eta^2 = .59$. Finally, and most important for our hypotheses, the latter main effect was qualified by a marginal interaction between the ego-depletion factor and the positive versus negative retrieved attributes, $F(1, 28) = 3.53$, $p = .07$, $\eta^2 = .11$. Follow-up analyses yielded that ego-depleted participants ($M = 5.21$, $SD = 1.89$) retrieved fewer positive self-relevant attributes than did nondepleted participants ($M = 7.06$, $SD = 2.49$), $F(1, 28) = 5.13$, $p = .03$, $\eta^2 = .16$. No difference between depleted ($M = 3.14$, $SD = 1.17$) and nondepleted participants ($M = 3.25$, $SD = 1.29$) was found for retrieved negative attributes, $F < 1$.

Above-average comparisons, future optimism, and perception of control. First, we collapsed the three subscales for future optimism, above average, and perception of control into one overall scale of positive illusion ($\alpha = .70$) and conducted an ANOVA with ego depletion as the independent variable. This analysis indicated that ego-depleted participants overall are significantly less optimistic ($M = 4.27$, $SD = 0.96$) than are nondepleted participants ($M = 5.09$, $SD = 1.18$), $F(1, 28) = 4.24$, $p = .05$, $\eta^2 = .13$.

In the following, we conducted separate analyses for the three single dimensions of positive illusions (i.e., above average, future optimism, perception of control). With regard to the above-average effect, a one-factorial ANOVA revealed a significant main effect for ego depletion, indicating that nondepleted participants assessed themselves more favorably compared with the average person ($M = 5.17$, $SD = 1.47$) than did depleted participants

($M = 4.16$, $SD = 1.07$), $F(1, 28) = 4.50$, $p = .04$, $\eta^2 = .14$. In addition, concerning future optimism, a significant main effect also occurred, indicating that nondepleted individuals ($M = 5.28$, $SD = 1.57$) were more optimistic about their future than were depleted individuals ($M = 4.24$, $SD = 1.19$), $F(1, 28) = 4.03$, $p = .05$, $\eta^2 = .13$. No significant difference between nondepleted ($M = 4.83$, $SD = 1.64$) and depleted participants ($M = 4.41$, $SD = 1.30$) was found for illusion of control, $F < 1$.

Self-esteem. A one-factorial ANOVA revealed no significant main effect for ego depletion and self-esteem, $F(1, 28) = 2.49$, $p = .13$, $\eta^2 = .08$ (low depletion: $M = 3.37$, $SD = 0.43$; high depletion: $M = 3.10$, $SD = 0.51$).

Self-efficacy. A one-factorial ANOVA revealed a significant main effect for ego depletion, indicating that nondepleted participants reported a higher sense of self-efficacy ($M = 2.92$, $SD = 0.50$) than did depleted participants ($M = 2.49$, $SD = 0.47$), $F(1, 28) = 5.80$, $p = .02$, $\eta^2 = .17$.

Mediational analyses I: Retrieved positive attributes. To test whether the number of generated/retrieved positive self-attributes mediates the impact of ego depletion on positive illusions (above-average effect, future optimism), we performed mediational analyses described by Baron and Kenny (1986). First, we correlated the number of retrieved positive attributes with the overall optimism scale ($r = .39$, $p = .03$), the above-average subscale ($r = .27$, $p = .16$), the perception of control subscale ($r = .24$, $p = .20$), and the future optimism subscale ($r = .43$, $p = .02$). Because the number of positive self-attributes only significantly correlated with the overall scale of optimism and the future optimism subscale, we only conducted mediational analyses for these two criteria variables. First, when we simultaneously predicted the overall scale of optimism by the ego-depletion factor as well as the potential

mediator for retrieved positive attributes, we found an overall significant regression equation, $R^2 = .21$, $F(2, 27) = 3.49$, $p = .045$. Although, the regression weight of the ego-depletion factor was reduced and did not further reach significance, $\beta = -.25$, $t(27) = -1.32$, $p = .20$, the regression weight of the potential mediator for retrieved positive attributes also did not reach significance, $\beta = .30$, $t(27) = 1.59$, $p = .12$. Second, when we simultaneously predicted future optimism by the ego-depletion factor as well as the potential mediator for retrieved positive attributes, we again found an overall significant regression equation, $R^2 = .22$, $F(2, 27) = 3.89$, $p = .03$. Positive attributes received a marginal significant regression weight, $\beta = .34$, $t(27) = 1.85$, $p = .08$, whereas the ego-depletion factor did not reach significance, $\beta = -.22$, $t(27) = -1.20$, $p = .24$.

Mediational analyses II: Self-efficacy. In the next step, we tested whether self-efficacy mediates the effect of ego depletion on positive illusions. We correlated self-efficacy with the overall scale of optimism ($r = .65$, $p < .001$), above-average considerations ($r = .44$, $p = .02$), and future optimism ($r = .53$, $p = .003$). Hence, we conducted mediational analyses for these three variables. Concerning the overall optimism scale, a significant regression equation was obtained when the ego-depletion factor and self-efficacy were simultaneously employed to predict the overall optimism scale, $R^2 = .44$, $F(2, 27) = 10.41$, $p < .001$. Whereas self-efficacy received a significant regression weight, $\beta = .61$, $t(27) = 3.81$, $p = .001$, the ego-depletion factor no longer reached significance, $\beta = -.11$, $t(27) = -0.70$, $p = .49$. With regard to future optimism, a significant regression weight was observed when future optimism was simultaneously predicted by ego depletion and self-efficacy, $R^2 = .30$, $F(2, 27) = 5.86$, $p = .01$. Self-efficacy received a significant regression weight, $\beta = .46$, $t(27) = 2.62$, $p = .01$, whereas the ego-depletion factor no longer reached significance, $\beta = -.16$, $t(27) = -0.93$, $p = .36$. Moreover, with regard to the above-average effect, a significant regression equation was observed when the above-average effect was simultaneously predicted by ego depletion and self-efficacy, $R^2 = .23$, $F(2, 27) = 4.02$, $p = .03$. Whereas self-efficacy received a marginal significant regression weight, $\beta = .33$, $t(27) = 1.79$, $p = .085$, the ego-depletion factor no longer reached significance, $\beta = -.24$, $t(27) = -1.27$, $p = .22$.

In summary, Study 5 replicated the findings of Study 4, that is, ego-depleted participants were less able to generate/retrieve positive-self-relevant information from their cognitive system. In addition and most important, this differential retrieval process was shown to mediate the impact of the ego-depletion manipulation on the occurrence of positive views on the self (positive illusions).

Also, the underlying psychological processes also have been elucidated by the finding that ego-depleted participants reported a lower sense of self-efficacy and that self-efficacy, in turn, mediated the impact of ego depletion on positive illusions. A limitation of Study 5 is that, at the levels of the subscales (above-average, future optimism, control), a significant positivity-reducing effect of ego depletion only was found for the subscales of above-average and future optimism. Moreover, a substantial mediation via retrieved positive attributes only was found for the subscale of future optimism. Hence, the impaired retrieval of positive self-relevant attributes might not be the only mechanism that is impaired by a state of ego depletion and thus leads to less-optimistic self-views (we indeed found that the subjective sense of self-efficacy is another important mediator in this context). Consistent with the findings of Vohs et al. (2005, Study 8), we did not find a significant impact of ego depletion on reported self-esteem.

GENERAL DISCUSSION

In the present investigation, we assumed that the construction of positive views (positive illusions) about the self can require the active self (self-regulation). More specifically, we proposed that positive views on the self may require complex defensive processes—such as suppressing inconsistent or threatening self-relevant information, searching the memory for positive self-relevant information, and intentionally biasing the encoding, processing, and retrieval of self-relevant information—and thus, as a consequence, they might require self-regulatory resources. The present investigation manipulated ego depletion by having some participants engage in an initial act of self-regulation. Participants were instructed to regulate their attention, thoughts, or emotional responses. Afterward, the ability to construct positive views about one's own abilities, perception of control, and future expectations was measured.

The results of these five studies consistently showed that ego depletion impaired the ability to construct positive views of the self. More specifically, compared with nondepleted participants, ego-depleted participants were less optimistic about one's own abilities (above-average effect; Study 1), had a lower sense of control (illusion of control; Study 2), and exhibited less-optimistic future expectations (optimism; Study 3). Likewise, the present research suggested that ego-depleted participants exhibit less-optimistic illusions because their ability to generate and retrieve positive self-relevant information has been impaired (Studies 4 and 5) and because they have a lowered sense of general self-efficacy (Study 5). The main implication of the present research is that a positive view

of the self (positive illusions) requires the active self to emerge. When the self is depleted by a prior regulatory task, the ability to construct positive illusions is impaired.

Implications, Limitations, and Future Research

First, the present studies strengthened the limited resource model. Self-control is an important resource that is involved in many cognitive, motivational, and behavioral processes or responses of human beings, such as intellectual performance, decision making, or physical stamina. The present investigation added positive views of the self (positive illusions) as another phenomenon requiring resources of the active self.

Second, the present studies supported theoretical models that postulate that optimistic perspectives and positive illusions about the self are not only the result of low-processing efforts. The data presented here suggested that optimistic illusions can require the deliberate, active role of the self to occur. Consequently, constructing and maintaining a positive view of the self seems to be an effortful process, which is easily impaired or reduced by competing tasks that require the same regulatory resource. By postulating and demonstrating these effects, it initially appears that we contradict established research concerning, for example, “automatic egotism” (Paulhus et al., 1989), which demonstrated that self-evaluation while performing another concurrent task led to more (instead of less) positive self-views. However, the most important methodological difference between our studies and the work of Paulhus and colleagues is based in the realm of how the dependent variable is measured. Paulhus and colleagues asked participants to rate themselves on traits, so it was very easy to follow a simple rule of embracing the positive and rejecting the negative. Hence, the simpler and more positive responses that Paulhus and colleagues observed when people were distracted by a concurrent task. In contrast, the present research (especially Studies 4 and 5, which are supposed to be those that most closely illuminate the underlying psychological processes) required participants to generate/retrieve their own attributes from memory and introspection. This requires considerably more work than deciding about self-consistency or self-inconsistency and may therefore explain why depleted participants furnished less. Also, the procedure of the present Study 4 is not as easy to bias with a simple positivity rule compared with, for example, the procedure employed by Paulhus et al. (1989). In the present research, participants were asked to list “all of their positive and negative self-relevant attributes and characteristics.” Thus, the requirement by instruction was to be balanced and thorough. In short, to integrate this with automatic egotism, we think that depleted capabilities more easily lead

people to follow simple and positive rules when responding to attributes suggested by someone else, but when they really must actively engage in the generation of their own attributes, they have fewer resources with which to bias the list of positive and negative attributes in their favor.² To move research in this area forward, future studies could directly test whether ego depletion impairs the construction of positive illusions based on rather effortful processes but not those based on simpler, less-effortful processes. This could be tested by an experiment using a 2 (ego depletion) \times 2 (rating difficulty) \times 2 (judgment) design. For example, after being depleted, participants could perform an easy task (e.g., rating themselves and/or others) and a complex task (writing down positive and negative attributes about self and/or others). Due to our line of argumentation, one should find a three-way interaction, such that the depletion manipulation matters only when participants make difficult self-ratings.

Third, self-regulation resources seem to be an active component of various types of optimistic illusions, such as the perception of own abilities, controllability of the external world, and future expectations. Thus, the present research will help to reduce complexity in research on positive illusions because self-regulatory resources seem to be a common, important component of various forms of this phenomenon. In addition, our research revealed that the use of both attentional and emotional control manipulations similarly reduced positive self-views. This is a strong methodological feature of the present studies and we recommend that similar types of resource depletion are employed in future research within the field of ego depletion and positive illusions.

Fourth, the present investigation clarified the psychological processes underlying the impact of self-regulatory resources on the construction of optimistic illusions. Explicitly, ego-depleted participants generated and retrieved less positive self-relevant information than did nondepleted participants, which was shown to mediate the impact of ego depletion on future optimism. In addition, clearer results were found for self-efficacy, which has been shown to be a substantial mediator for the impact of ego depletion on overall optimistic views of the self as well as specifically (in a somewhat attenuated strength) for above-average considerations and future optimism. Thus, our results lent support to the assumption that the emergence of positive illusions depends on the access to positive self-relevant information and, in addition, demonstrated that the impact of self-regulation on the occurrence of positive views of the self (positive illusions) is significantly linked to the ability to generate or retrieve positive self-relevant information as well as to the subjective experience of self-efficacy (which is supposed to be a direct indicator of the functioning self).

Fifth, it is important to ask whether our findings are unique to positive illusions or whether perhaps other evaluative judgments may be affected by ego-depletion manipulations in the same direction. Although our own research shows that ego depletion differently affects the external information search (which is supposed to be based on a simpler strategy than the judgment tasks and internal memory search of the present research; in addition, because the depleted self is less able to construct positivity, it might be useful to search at least for external self-serving information; Fischer et al., 2007), to definitely rule out this point empirically, future research would need to simultaneously compare positive illusions with some other types of (less self-relevant) judgments and then show that the ego-depletion manipulation has a greater or differential effect on the former than the latter.

Sixth, it is important to note that task difficulty of employed ego-depletion manipulations might represent an alternative explanation for our data. More specifically, failure to follow the instructions of the experimenter (e.g., to suppress emotions, redirect attention, or override behavioral rules—especially in the very difficult version of the depletion task employed in Study 4 [crossing the *es*]) might have directly led to lower impressions and/or assessments of the self and the self's abilities, which could have contributed directly to a lower sense of optimism and less-optimistic views of the self's attributes. In other words, it is possible that participants in the ego-depletion conditions had difficulties with successful self-regulation, which led to lower self-evaluations and, in turn, to lower self-enhancement. However, this argument applies less to the other studies of the present research (which employed fewer performance-oriented manipulations of regulatory resources, such as the suppression of emotions or thoughts), so the rule of parsimony would downplay it as an alternative explanation. However, it would be an interesting avenue for future research that investigated the interplay between ego-depletion manipulations with different difficulty levels and associated failure experiences, the perception of the self's abilities, and the construction of positive illusions.

Another related alternative explanation for our findings can be derived from empirical work and theorizing by Wegner and colleagues (e.g., Wegner, 1994; Wegner, Erber, & Zanakos, 1993), who set forth the ironic process theory, which postulates that mental control processes are based on two different processes, one conscious and deliberate process (intentional operating process) and one rather unconscious, automatic process (ironic monitoring process). For example, when people try to experience positive emotions, the intentional operating process helps them to deliberately select positive thoughts from their memory (because they are expected to support the attainment of a positive mood state). In

contrast, the ironic monitoring process works in the background to check for when mental control attempts failed (e.g., negative thoughts came to the conscious mind) and thus the whole process should be started again. Especially important for our line of research is the assumption that this ironic monitoring process detects failures of mental control and thus increases the salience of mental contents that are associated with these failures (cf. Higgins & King, 1981; Lombardi, Higgins, & Bargh, 1987). The counterintuitive result would be that individuals who try to find positive thoughts will automatically as a byproduct increase the accessibility of negative thoughts, too. According to Wegner et al. (1993), this should be especially true when the resources of the deliberate processing system are reduced, for example, by cognitive load, stress, or time pressure. Hence, our results that ego-depleted participants are less optimistic and retrieve less positive self-relevant attributes could be a consequence of this ironic monitoring process detecting failures of mental control (which should be significantly increased in the high-depletion conditions) rather than of attenuated resources to construct positive illusions. Accordingly, it would be an important question for future research on ego depletion and positive illusions to investigate whether ego-depletion effects can be reinterpreted within the alternative theoretical perspective of the ironic process theory.

Finally, the external validity of our findings has to be discussed. For example, previous research yielded individuals who, after facing life-threatening situations (e.g., cancer diagnoses; Taylor & Lobel, 1989), behaved rather self-enhancing (by conducting downward comparisons). Thus, it seems that even under extremely aversive and difficult circumstances, people are able to manage to construe positive views of themselves. Along those same lines, it might be a fruitful endeavor for future research to investigate the availability of regulatory resources in situations of extreme adversity.

NOTES

1. Please note that this effect was not found for participants under cognitive load.

2. We want to thank Professor Dr. Roy Baumeister for this important and very helpful case for how to integrate our work with contradictory findings on automatic egotism.

REFERENCES

- Alicke, M. D. (1985). Global self-evaluation as determined by the desirability and controllability of trait adjectives. *Journal of Personality and Social Psychology*, 49, 1621-1630.

- Alicke, M. D., Klotz, M. L., Breitenbecher, D. L., Yurak, T. J., & Vredenburg, D. S. (1995). Personal contact, individuation, and the above-average effect. *Journal of Personality and Social Psychology*, 68, 804-825.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Barkley, R. A. (1997). Behavioral inhibition, sustained attention, and executive functions: Constructing a unifying theory of ADHD. *Psychological Bulletin*, 121, 65-94.
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research. Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173-1182.
- Baumeister, R. F., Bratlavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology*, 74, 1252-1265.
- Baumeister, R. F., DeWall, C. N., Ciaracco, N. J., & Twenge, J. M. (2005). Social exclusion impairs self-regulation. *Journal of Personality and Social Psychology*, 88, 589-604.
- Baumeister, R. F., & Heatherton, T. F. (1996). Self-regulation failure: An overview. *Psychological Inquiry*, 7, 1-15.
- Baumeister, R. F., Twenge, J. M., & Nuss, C. K. (2002). Effects of social exclusion on cognitive processes: Anticipated aloneness reduces intelligent thought. *Journal of Personality and Social Psychology*, 83, 817-827.
- Beck, A. T. (1976). *Cognitive therapy and the emotional disorders*. New York: International Universities Press.
- Brown, J. D. (1986). Evaluations of self and others: Self-enhancement biases in social judgments. *Social Cognition*, 4, 353-376.
- Chaiken, S., Giner-Sorolla, R., & Chen, S. (1996). Beyond accuracy: Defense and impression motives in heuristic and systematic information processing. In P. M. Gollwitzer & J. A. Bargh (Eds.), *The psychology of action: Linking cognition and motivation to behavior* (pp. 553-578). New York: Guilford.
- Chaiken, S., Liberman, A., & Eagly, A. H. (1989). Heuristic and systematic information processing within and beyond the persuasion context. In J. S. Uhleman & J. A. Bargh (Eds.), *Unintended thought* (pp. 212-252). New York: Guilford.
- Chambers, J. R., & Windschitl, P. D. (2004). Biases in social comparative judgments: The role of nonmotivated factors in above-average and comparative-optimism effects. *Psychological Bulletin*, 130, 813-838.
- Clark, M. S., & Isen, A. M. (1982). Toward understanding the relationship between feeling states and social behavior. In A. H. Hastorf & A. M. Isen (Eds.), *Cognitive social psychology* (pp. 73-108). New York: American Elsevier.
- Crocker, J. (1982). Biased questions in judgment of covariation studies. *Personality and Social Psychology Bulletin*, 8, 214-220.
- DeWall, C. N., & Baumeister, R. F. (2006). Alone but feeling no pain: Effects of social exclusion on physical pain tolerance and pain threshold, affective forecasting, and interpersonal empathy. *Journal of Personality and Social Psychology*, 91, 1-15.
- Ditto, P. H., & Lopez, D. F. (1992). Motivated skepticism: Use of differential decision criteria for preferred and nonpreferred conclusions. *Journal of Personality and Social Psychology*, 63, 568-584.
- Ditto, P. H., Scepansky, J. A., Munro, G. D., Apanovitch, A. M., & Lockhart, L. K. (1998). Motivated sensitivity to preference-inconsistent information. *Journal of Personality and Social Psychology*, 75, 53-69.
- Ellis, A. (1962). *Reason and emotion in psychotherapy*. New York: Stuart.
- Fischer, P., Greitemeyer, T., & Frey, D. (2007). *Ego depletion and selective exposure: The impact of self-regulation on confirmatory information search*. Manuscript submitted for publication.
- Fischer, P., Jonas, E., Frey, D., & Schulz-Hardt, S. (2005). Selective exposure to information: The impact of information limits. *European Journal of Social Psychology*, 35, 469-492.
- Fiske, S. T., & Taylor, S. E. (1984). *Social cognition*. Reading, MA: Addison-Wesley.
- Freud, S. (1957). Repression. In J. Strachey (Ed. and Trans.), *The standard edition of the complete psychological works of Sigmund Freud* (Vol. 14, pp. 146-158). London: Hogarth. (Original work published 1915)
- Gilbert, D. T., Krull, D. S., & Pelham, B. W. (1988). Of thoughts unspoken: Social inference and the self-regulation of behavior. *Journal of Personality and Social Psychology*, 55, 685-694.
- Greenwald, A. G. (1980). The totalitarian ego: Fabrication and revision of personal history. *American Psychologist*, 35, 603-618.
- Harris, P., & Middleton, W. (1994). The illusions of control and optimism about health: On being less at risk but no more in control than others. *British Journal of Social Psychology*, 33, 369-386.
- Heatherton, T. F., & Baumeister, R. F. (1996). Self-regulation failure: Past, present, and future. *Psychological Inquiry*, 7, 90-98.
- Higgins, E. T., & King, G. (1981). Accessibility of social constructs: Information-processing consequences of individual and contextual variability. In N. Cantor & J. F. Kihlstrom (Eds.), *Personality, cognition, and social interaction* (pp. 69-121). Hillsdale, NJ: Lawrence Erlbaum.
- Hoorens, V., & Buunk, B. P. (1993). Social comparison of health risks: Locus of control, the person-positivity bias, and unrealistic optimism. *Journal of Applied Social Psychology*, 23, 291-302.
- Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology*, 77, 1121-1134.
- Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin*, 108, 480-498.
- Lombardi, W. J., Higgins, E. T., & Bargh, J. A. (1987). The role of consciousness in priming effects on categorization: Assimilation versus contrast as a function of awareness of the priming task. *Personality and Social Psychology Bulletin*, 13, 411-429.
- Markus, H., & Nurius, P. (1986). Possible selves. *American Psychologist*, 41, 954-969.
- McKenna, F. P. (1993). It won't happen to me: Unrealistic optimism or illusions of control? *British Journal of Psychology*, 84, 39-50.
- Miller, D. T., & Ross, M. (1975). Self-serving biases in attribution of causality: Fact or fiction? *Psychological Bulletin*, 82, 213-225.
- Muraven, M., & Baumeister, R. F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin*, 126, 247-259.
- Muraven, M., Tice, D. M., & Baumeister, R. F. (1998). Self-control as limited resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology*, 74, 774-789.
- Paulhus, D., Graf, P., & Van Selst, M. (1989). Attentional load increases the positivity of self-presentation. *Social Cognition*, 7, 389-400.
- Perloff, L. S., & Fetzer, B. K. (1986). Self-other judgments and perceived vulnerability of victimization. *Journal of Personality and Social Psychology*, 50, 502-510.
- Prentice, D. A. (1990). Familiarity and differences in self- and other-representations. *Journal of Personality and Social Psychology*, 59, 369-383.
- Rachman, S., & de Silva, P. (1978). Abnormal and normal obsessions. *Behavioural Research and Therapy*, 16, 233-248.
- Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.
- Schmeichel, J. S., Vohs, K. D., & Baumeister, R. F. (2003). Intellectual performance and ego depletion: Role of the self in logical reasoning and other information processing. *Journal of Personality and Social Psychology*, 85, 33-46.
- Schulz-Hardt, S., Fischer, P., & Frey, D. (2007). *Confirmation bias in accuracy-motivated decision-making: A cognitive explanation for biased information seeking*. Manuscript submitted for publication.
- Schwarzer, R., & Jerusalem, M. (1995). Self-efficacy measurement: Generalized self-efficacy scale (GSES). In J. Weinman, S. Wright, & M. Johnston (Eds.), *Measures in health psychology: A user's portfolio*. Windsor: NFER-Nelson.
- Schwarzer, R., & Scholz, U. (2000). *Cross-cultural assessment of coping resources: The general perceived self-efficacy scale*. Paper presented at the First Asian Congress of Health Psychology, Health Psychology and Culture, Tokyo, Japan.
- Shrauger, J. S., & Schoeneman, T. J. (1979). Symbolic interactionist view of self-concept: Through the looking glass darkly. *Psychological Bulletin*, 86, 549-573.

- Snyder, M., & Swann, W. B. (1976). When actions reflect attitudes: The politics of impression management. *Journal of Personality and Social Psychology, 34*, 1034-1042.
- Swann, W. B., Jr. (1983). Self-verification: Bringing social reality into harmony with the self. In J. Suls & A. G. Greenwald (Eds.), *Social psychology perspectives* (Vol. 2, pp. 33-66). Hillsdale, NJ: Lawrence Erlbaum.
- Taylor, S. E., & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin, 103*, 193-210.
- Taylor, S. E., & Crocker, J. (1981). Schematic bases of social information processing. In E. T. Higgins, C. P. Herman, & M. P. Zanna (Eds.), *Social cognition: The Ontario Symposium* (Vol. 1, pp. 89-134). Hillsdale, NJ: Lawrence Erlbaum.
- Taylor, S. E., Lerner, J. S., Sherman, D. K., Sage, R. M., & McDowell, N. K. (2003). Portrait of the self-enhancer: Well-adjusted and well-liked or maladjusted and friendless? *Journal of Personality and Social Psychology, 84*, 165-176.
- Taylor, S. E., & Lobel, M. (1989). Social comparison activity under threat: Downward evaluation and upward contacts. *Psychological Review, 96*, 569-575.
- Tetlock, P. E. (1983). Accountability and complexity of thought. *Journal of Personality and Social Psychology, 45*, 74-83.
- Vohs, K. D., Baumeister, R. F., & Ciarocco, N. J. (2005). Self-regulation and self-presentation: Regulatory resource depletion impairs impression management and effortful self-presentation depletes regulatory resources. *Journal of Personality and Social Psychology, 88*, 632-657.
- Vohs, K. D., Baumeister, R. F., & Tice, D. M. (2006). Self-regulation: Goals, consumption, and choices. In C. P. Haugtvedt, P. Herr, & F. Kardes (Eds.), *Handbook of consumer psychology*. Mahwah, NJ: Lawrence Erlbaum.
- Vohs, K. D., & Faber, R. J. (in press). Spent resources: Self-regulatory resource availability affects impulse buying. *Journal of Consumer Research*.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*, 1063-1070.
- Wegner, D. M. (1994). Ironic processes of mental control. *Psychological Review, 101*, 34-52.
- Wegner, D. M., Erber, R., & Zanakos, S. (1993). Ironic processes in the mental control of mood and mood-related thought. *Journal of Personality and Social Psychology, 65*, 1093-1104.
- Wegner, D. M., Schneider, D. J., Carter, S. R., & White, T. L. (1987). Paradoxical effects of thought suppression. *Journal of Personality and Social Psychology, 53*, 5-13.
- Weinstein, N. D. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology, 39*, 806-820.
- Zadro, L., Williams, K. D., & Richardson, R. (2004). How low can you go? Ostracism by a computer is sufficient to lower self-reported levels of belonging, control, self-esteem, and meaningful existence. *Journal of Experimental Social Psychology, 40*, 560-567.

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