TECHNISCHE UNIVERSITÄT MÜNCHEN

TUM School of Management

Lehrstuhl für Psychologie

Fear-Induced Self-Control Depletion:

Effects of State Fear and Trait Self-Control on Subsequent Self-Controlled Behavior and Motivation

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Vollständiger Abdruck der von der Fakultät TUM School of Management der Technischen Universität München zur Erlangung des akademischen Grades eines

Doktors der Philosophie (Dr. phil.)

genehmigten Dissertation.

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Prüfer der Dissertation:	1.	Univ.-Prof. Dr. Hugo M. Kehr
	2.	Univ.-Prof. Dr. Claudia Peus

Die Dissertation wurde am 14.08.2013 bei der Technischen Universität München eingereicht und durch die Fakultät TUM School of Management am 15.10.2013 angenommen.

"Anxiety does not empty tomorrow of its sorrows,
but only empties today of its strength."
Charles H. Spurgeon

Acknowledgments

This dissertation would not have been possible without the encouragement of the many people who supported me as teachers or colleagues or accompanied me as friends through recent years.

First and foremost, I would like to thank my supervisor, Hugo M. Kehr, for his contagious enthusiasm for motivational psychology, for his guidance and his constructive comments on my work, and for giving me the freedom to explore and develop my research interests. I am especially grateful to him for hosting the Munich Symposium on Motivation, the TUM Kolloquium zur Motivationsforschung und -praxis, and the Motivationspsychologisches Kolloquium, which gave me the opportunity to discuss my research with members of the leading research groups in the field of motivation and self-control.

I am deeply grateful to Claudia Peus for the assessment of my dissertation, and I would like to thank Nicola Breugst for agreeing to chair my committee.

Many thanks go to Dorena and Susi for their helpful comments on the first draft; and Jane Zagorski and Karl Hughes for proofreading the manuscript so conscientiously. Additionally, I would like to thank all the student assistants who helped to collect the data for this dissertation and especially all the participants who sacrificed their valuable time to participate in the experiments. I would also like to thank Alex, Anja, Elisabeth, Kaspar, and Matthias for the inspiring conversations and for sharing our stressful and joyful moments during this exciting period of graduation. I am also grateful to everyone else at the Chair of Psychology at the Technische Universität München and to the TUM Graduate School.

Most of all, this dissertation would not have been possible without the love and patience of my family: Thanks to Stefan, for all the technical and emotional sup-

port and his unlimited trust in me. My parents deserve special gratitude for their confidence and motivation. Last but not least, I am grateful to my dear friends for their patience and understanding while I undertook this time-intensive dissertation and was mostly unavailable—until now!

Berlin, August 2013

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Abstract

Seven studies (N = 867) demonstrated that fear regulation consumes peoples' limited resource of self-control. The compensatory model of motivation and volition proposes that threatening situations can lead to an intrapersonal conflict between fear-induced responses and the goal-related tendency to perform a task well. In order to reach the desired goals, participants were expected to regulate fear-induced responses such as intrusive thoughts, affective states, and altered facial expressions and to expend their limited self-control resource during this regulation task. Fear was induced by using the public speech task. Primed with the fear of giving a public speech, participants reported lower state self-control, achieved lower scores on the implicit association test, and performed worse on subsequent self-control tasks such as the handgrip task, the anagram task, and the working memory capacity task compared with the control group participants. Additionally, this investigation showed that participants high (vs. low) in trait self-control were less depleted after the fear induction. These findings show that fear regulation depends on self-control and leads to its depletion. These findings support the compensatory model of motivation and volition and theories of limited self-control.

Zusammenfassung

Sieben Studien (N = 867) zeigten, dass Furchtregulation die limitierte Selbstkontrollressource erschöpft. Das Kompensationsmodell von Motivation und Volition sagt vorher, dass furchtauslösende Situationen zu einem intrapersonellen Konflikt führen können, der durch gegenläufige Tendenzen gekennzeichnet ist: Erstens Furcht zu vermeiden und zweitens das gesetzte Ziel zu verfolgen, z.B. eine Aufgabe gut zu bewältigen. Um das gesetzte Ziel zu verfolgen und zu erreichen, regulieren Menschen die furchtinduzierten Tendenzen wie intrusive Gedanken, Gefühle und Mimik. Es wurde postuliert, dass diese Regulation die Selbstkontrollressource erschöpft. Furcht wurde mit Hilfe der Sprechangst-Anordnung induziert. Probanden in der Furchtbedingung berichteten niedrigere Selbstkontrollwerte auf der Selbstreportskala, erzielten niedrigere Werte bei einem impliziten Assoziationstest und zeigten schlechtere Leistungen bei Selbstkontrollaufgaben wie der Handgripaufgabe, der Anagrammaufgabe und der Arbeitsgedächtnisaufgabe verglichen mit den Probanden der Kontrollgruppe. Zusätzlich wurde gezeigt, dass Probanden mit hoher (vs. niedriger) dispositionalen Selbstkontrolle nach der Furchtinduktion weniger erschöpft waren. Die Befunde sprechen dafür, dass beim regulieren der Furcht Selbstkontrolle erschöpft wird. Die Befunde stützen das Kompensationsmodell von Motivation und Volition sowie die Theorien zur limitierten Selbstkontrolle.

Introduction

The main goal of this research was to examine whether fear regulation depletes a person's limited resource of self-control, resulting in a state of depletion (self-control depletion). Even though fear accompanies individuals across diverse spheres of life—for example, performance situations often induce fear (e.g., Zeidner, 1998)—no studies to date have investigated whether fear regulation depletes self-control.

People must rely on self-control to accomplish various tasks of daily living and to perform well in their professional lives (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998). Used up by fear, subsequent attempts to exert self-control begin to fail, even in spheres unrelated to fear such as sticking to a diet by choosing a healthy meal instead of eating fast food, resisting the urge to drink or smoke, resisting temptations in general, controlling emotions and emotional expression, restraining aggression, pushing oneself to keep working on a paper on a beautiful summer afternoon, keeping promises, meeting the next challenge, and the like (Hagger, Wood, Stiff, & Chatzisarantis, 2010).

In the introduction, I will outline the core idea of the present research: that fear regulation depletes self-control. This section provides a foundation for this idea and develops a framework for an investigation of theories that incorporate aspects of fear regulation into considerations of self-control.

To outline how fear is expected to affect self-control, I will begin by defining fear, its activation mechanisms, and the fear responses that follow fear activation. Next, I will focus on the necessity to regulate fear responses. Further, I will expound on the strategies that individuals apply to regulate their fear responses. Regulation of fear responses will be integrated into the compensatory model of work motivation and volition (Kehr, 1999, 2000, 2004c, 2004d) and viewed from within the framework of

the limited resource models of self-control (e.g., Baumeister et al., 1998; Muraven & Baumeister, 2000). These theories provide a profound framework that outlines why fear regulation is assumed to rely on self-control and why it is assumed to deplete this limited resource. To substantiate the theoretical assumption, a report on the findings of previous research on the depleting effects of emotion regulation and fear regulation will follow. With a focus on the limitations of existing studies, the implications for the present research will be derived, including the strategies that can be applied to overcome those limitations.

Introduction to the Regulation of Fear

> Once activated, fear runs its course, with limited possibilities for cognitive interventions. (Öhman & Mineka, 2001, p. 506)

Origins and sources of fear. Countless situations that people have to master are frightening. Such situations are part of the professional and private lives of almost all people. For example, performance situations, such as taking a test or giving a public speech tend to be accompanied by fear (Carver, 2005; Veale, 2003; Zeidner, 1998). Fear is defined as an emotion and an emotional response to physical and psychosocial threats (e.g., Gross, 2009). A strict definition of emotions in general and fear in particular is difficult because of the numerous facets of fear (Solomon, 2000). Fear is mostly conceptualized as a whole-body response to a threat, affecting subjective experience, cognition, facial expression, peripheral physiology, and behavior (Endler & Parker, 1990; Gross, 2007; Mauss, Bunge, & Gross, 2007; Thompson, 1994). The processes activated by a threat are loosely linked and can differ depending on the stimulus. Threats can be real or anticipated (Öhman, 2008), and they can activate fear responses, even when the threats are not consciously perceived (Globisch, Hamm, Esteves, & Öhman, 1999; Öhman, 1993; Öhman & Wiens, 2003).

The subjective experience is tightly bound up with the everyday usage of the terms affect, emotion, or feeling (Gross, 2007; Thompson, 2011). Fear is an unpleasant state accompanied by subjective feelings of tension and nervousness, which vary in intensity over time (Brooks & Schweitzer, 2011; Gray, 1999; Spielberger, 1966).

In addition to inducing negative feelings, fear usually leads to worries and unwanted intrusive thoughts (Spielberger & Vagg, 1995; Zeidner, 1998). For example, before giving an oral presentation, individuals are usually worried about the difficulty of the task, negative evaluation, lack of preparation, and poor speaking skills (Sarason, 1980; Zeidner, 1998). The occurrence of unwanted intrusive thoughts is a normative phenomenon in many threatening situations (Rachman & De Silva, 1978; Sarason, 1984). Abundant research has demonstrated that these negative thoughts follow immediately after threatening stimuli, such as anticipating one's death (Greenberg, Pyszczynski, Solomon, Simon, & Breus, 1994), dental pain (Kent & Gibbons, 1987), or performing in public (Erdmann & Janke, 2002; Zeidner, 1998) among other stimuli (Beck, 1976; Beck, Emery, & Greenberg, 1985; Lang, 1968; Stopa & Clark, 1993). Intrusive thoughts, in turn, reinforce fear or even elicit fear in the first place (Beck, 1976; M. W. Eysenck, Derakshan, Santos, & Calvo, 2007; Lewis, Haviland-Jones, & Barrett, 2008).

Other important responses to fear are intense bodily manifestations (Lader & Marks, 1971), such as observably altered facial expressions, changes in posture and voice (Spielberger & Vagg, 1995), increased heart rate, shortness of breath, and sweaty palms (Heimberg, Juster, Hope, & Mattia, 1995). The ubiquity of fear has rendered it a central topic in research and clinical investigations (Barlow, 2002; Öhman, 2008).

Most researchers also refer to the state component of fear as anxiety, using the two terms interchangeably (Brooks & Schweitzer, 2011; Lewis et al., 2008). Fear

and anxiety are aversive states activated by a threat (Lewis et al., 2008). Nevertheless, some researchers distinguish between fear and anxiety (e.g., Beck et al., 1985; Öhman, 2008), labeling the cognitive and behavioral regulation of the danger as fear and the tense emotional state as anxiety (Beck et al., 1985). As fear and anxiety have a joint origin in an unconscious response mobilization activated by a threat, processes associated with both fear and anxiety are equally important for the present investigation. As it is beyond the scope of this work to further differentiate between fear and anxiety, I use the two terms interchangeably as suggested in the literature (Brooks & Schweitzer, 2011).

Within this work, when using the terms fear or anxiety, I am referring to the state components of fear. These consist of emotions, thoughts, and behavioral and physiological reactions, the so-called *fear responses* (Bellack & Lombardo, 1984). This work clearly focuses on the *state* components of fear rather than trait anxiety (Elliot, 1997; McClelland, Atkinsons, Clark, & Lowell, 1953; Spielberger, 1966). *Traits* are relatively stable constructs, and from a functional perspective, they are rigid and less useful for explaining why all people, despite their different predispositions for perceiving situations as more or less threatening, are affected by a threat (Spielberger, 1966). Experimentally manipulated state fear allows for the investigation of whether fear regulation leads to the depletion of self-control for any individual.

Functions of fear. First, fear facilitates survival in hazardous situations (Öhman, 2008). Fear activates an adaptive mechanism that enables the rapid detection of danger (Gross, 2008; Hartley & Phelps, 2009) and helps to fulfill a basic goal of biological evolution, namely, to stay alive (Esteves, Dimberg, & Öhman, 1994; Öhman, 2008). This adaptive mechanism relies on the preserved "wisdom of the ages" (Lazarus, 1991, p. 820) that humans have developed to deal with various life threats. Thus, fear responses are often the consequence of evolutionary condition-

ing (LeDoux, 1996) and are supported by neuroendocrine changes, which provide metabolic support and energize avoidance-orientated behavior (Frijda, 1986; John, Robins, & Pervin, 2008; Öhman, 2008).

Unlike other emotions, fear leads immediately and automatically to cognitive and affective reactions and initiates rapid behavioral responses (Bellack & Lombardo, 1984; Robinson, 1998; N. K. Smith, Cacioppo, Larsen, & Chartrand, 2003). Fear supports rapid early information processing (Esteves et al., 1994; Öhman, 2008), sharpens awareness, enables quick decision-making, promotes social connections, and enhances the memory of important events (Phelps & LeDoux, 2005). Most importantly, fear-induced behavioral impulses initiate avoidance behavior away from anything intuitively appraised as harmful (Arnold, 1960), such as unhealthy chemicals in one's surroundings, an aggressive conspecific, or a predator (Lewis et al., 2008). Thus, on the one hand, fear is an adaptive response in a hazardous situation that helps individuals to survive (LeDoux, 1996). On the other hand, the imperative power of fear stimuli automatically leads to distracting feelings, intrusive thoughts, and behavioral impulses, which, even in nonhazardous situations, automatically guide attention away from the initial task (Gross, Richards, & John, 2006; Lewis et al., 2008) toward danger or threats, thus interrupting goal-attainment (Carver & Scheier, 1998; Higgins, 2001). To counteract such unwanted responses in nonhazardous situations, people spontaneously and deliberately regulate them (Forgas & Ciarrochi, 2002; Gross & Thompson, 2007; Mauss, Bunge, & Gross, 2007) for several reasons.

Reasons for Regulating Fear Responses

Before explaining all the relevant regulation strategies in detail, I will outline why individuals regulate fear responses. People must alter fear responses that occur in nonhazardous situations in order to function in life (Cicchetti, Ganiban, & Barnett,

1991; Gross & John, 2003; Gross et al., 2006; Kopp, 1982, 1989; Mauss, Cook, Cheng, & Gross, 2007; Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005; Phelps, Delgado, Nearing, & LeDoux, 2004; Salovey, Detweiler-Bedell, Detweiler-Bedell, & Mayer, 2008; Thompson, 1994). According to the model of perceived control (Rothbaum, Weisz, & Snyder, 1982), people self-regulate to maintain a sense of control and to achieve harmony between the self and the world or to adjust to others (Miyamoto & Kitayama, 2002; Shmueli & Muraven, 2007).

The three most common goals of fear response regulation (hereafter referred to as *fear regulation*) are first, to *repair mood* by turning negative feelings into neutral or positive ones (Richards & Gross, 2000); second, to follow *social norms* by masking undesirable facial expressions (J. A. Morris & Feldman, 1996); and third, to support *goal-attainment* that would otherwise be impeded by fear responses (Carver & Scheier, 1998; Higgins, 2001). Within this work, fear regulation implies the down-regulation or overriding of fear responses. The three goals of fear regulation are outlined below.

Mood repair. Studies have shown that individuals experience significant affective distress during fear induction (e.g., M. W. Eysenck et al., 2007). Given the aversive character of affective distress, people prefer to decrease its duration or intensity and to transform negative feelings into neutral states at the very least, but preferably into positive ones (Andrade & Cohen, 2007; Gross et al., 2006; Richards & Gross, 2000; Thayer, 1996; Yi & Baumgartner, 2004) and to maximize their positive feelings (Russell, 1994). Baumeister, Vohs, DeWall, and Zhang (2007) refer to the process of mood repair as a homeostatic process, whereas Gilbert, Pinel, Wilson, Blumberg, and Wheatley (1998) propose the term "psychological immune system" to refer to the mechanism that protects people from negative feelings and thoughts. Changing fear-induced negative affect into more comfortable feelings is a common action (Isen, 1984; Mayer & Gaschke, 1988; W. N. Morris & Reilly,

1987; C. A. Smith & Ellsworth, 1985; Thayer, 1996; Yi & Baumgartner, 2004). For example, studies on heart rate variability have shown that fear regulation is a natural reaction to threat (Applehans & Luecken, 2006; Croizet et al., 2004; Johns, Inzlicht, & Schmader, 2008).

Early research on coping with bad moods derived the implication that people in a negative mood indulge their impulses to feel better and give priority to the short-term goal of mood repair over other desired goals (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986; Isen, 1984; Tice, Bratslavsky, & Baumeister, 2001). The process of setting and pursuing the mood-repair goal may proceed even without the person's awareness of being engaged in goal-directed behavior (Bargh, Gollwitzer, Lee-Chai, Barndollar, & Trötschel, 2001). Several studies have indicated that individuals automatically set the mood-repair goal as soon as negative affect arises (see Bruyneel, Dewitte, Franses, & Dekimpe, 2009, for a review), and the mood-repair goal automatically activates a causal chain of immediate and active attempts to regulate mood (Bruyneel et al., 2009; W. N. Morris & Reilly, 1987). The theory of cognitive dissonance (Festinger, 1962) provides a theoretical model for the pursuit of a mood-repair goal, stating that people ameliorate negative moods and thoughts if these are inconsistent with the desired performance goal (Cooper & Fazio, 1984; Zanna, Higgins, & Taves, 1976). Forgas and Ciarrochi (2002) as well as Erber and Erber (2001) substantiated this theoretical assumption, observing that individuals spontaneously generate mood-incongruent thoughts. People may even engage in mood-incongruent behavior (e.g., prosocial behavior) while in a negative mood (e.g., feeling guilty) because they are driven by the anticipation of possible mood change (Cunningham, Steinberg, & Grev, 1980; Duval & Wicklund, 1972).

Social norms. Besides protecting oneself from feeling bad, in everyday life, people frequently have to regulate which emotions they express for social reasons

(J. A. Morris & Feldman, 1996; Richards & Gross, 2000). As fear leads to undesirable facial expressions, and showing fear might have adverse consequences, people mask or change them (J. A. Morris & Feldman, 1996; Richards & Gross, 2000). Some theorists even emphasize the fact that adults in western cultures constantly regulate their emotional expression, and the chances of observing an unregulated emotional expression are very low (Bargh, 1997; Greenwald & Banaji, 1995; Nosek, 2005; Richards & Gross, 2000; Tomkins, 2008).

The organizational literature coined the term *emotional labor* to refer to the regulation of visible facial and bodily expressions in work settings (Hochschild, 1983; J. A. Morris & Feldman, 1996; Wesner, Noyes, & Davis, 1990). For many professions such as medical staff, sales managers, and service personnel, the regulation of emotional expression is crucial to job success. As emotions are involuntarily expressed in the face due to the fact that the processes are highly automatized (Zajonc, 1985), negative expressions have to be modified into expressions of expected or appropriate emotions (Ekman, 1973; Russell, 1994). It is not only the regulation of one's own emotions that is considered beneficial: Individuals who are able to provide an emotional shield for others in times of aversive life events can gain a feeling of efficacy and social worth from this behavior (Stroebe & Stroebe, 1996). Indeed, individuals who are able to modify other people's emotional experiences and moods can be successful at impression management, persuasion, and building and maintaining solid social networks (Brackett, Rivers, Shiffman, Lerner, & Salovey, 2006; Salovey, Mayer, Caruso, & Yoo, 2008). Thus, successful emotion regulation is conductive to identifying with and belonging to a group. It provides power and indirect opportunities for exerting control over the group (Stevens & Fiske, 1995; Tangney, Baumeister, & Boone, 2004).

Goal attainment. Besides looking better and cheering oneself up, individuals down-regulate fear to successfully achieve an intended or desired goal. Fear regulation can be essential for achieving goals that require actions that are in contrast to those induced by fear. As fear responses and tendencies have control over other current actions, it is imperative to down-regulate them (Frijda, 1986; Gross & Thompson, 2007). For example, fear-induced task-irrelevant thoughts interrupt goal-oriented planning and might impede performance (Elliot, Sheldon, & Church, 1997; M. W. Eysenck & Calvo, 1992; Sarason, 1984; Wood, Mathews, & Dalgleish, 2001). Thus, people down-regulate negative emotions to set up a state that will support the enactment of the actual goal (Bagozzi, Verbeke, & Gavino, 2003; Gross & Thompson, 2007).

For some people, the down-regulation of fear is essential for goal attainment. For example, for stage performers and lecturers, a fear of acting or speaking in front of people could disrupt their performance or even end their career. It is not only on-the-job performance that depends on effective emotion regulation. The educational system in particular exposes students to highly competitive, *self-threatening* situations—for example, when taking an important evaluative test, students often experience fear due to factors that are intrinsic to the task, such as time pressure, attention overload, and the possibility of failing (Middlestadt, Ottati, Straus, Fishbein, & Ellis, 1988; Wesner et al., 1990). Thus, in order to perform well, students have to regulate fear (Cadinu, Maass, Rosabianca, & Kiesner, 2005; Gross, 1999, 2002; Jamieson & Harkins, 2007; Johns et al., 2008). The motivation to regulate fear is also enhanced by the common belief that negative thinking and negative mood might impede a person's performance on demanding tasks (Johns et al., 2008; T. W. Smith, Snyder, & Handelsman, 1982). Thus, people regulate fear to support their intended or desired goals (Carver & Scheier, 1998; Higgins, 2001).

All in all, emotion regulation is crucial for the ability to interact smoothly with others in private life and for success in most work environments (Gross & Munoz, 1995).

Fear Regulation

Emotion regulation in general and fear regulation as a special case of emotion regulation refer to the heterogeneous set of strategies that individuals apply to counteract, suppress, or override at least one aspect of emotional response. Examples of fear-induced responses are negative affect, intrusive thoughts, altered facial expressions, changes in peripheral physiology, or behavioral impulses (e.g., Bargh & Williams, 2007; Eisenberg & Spinrad, 2004; Goldsmith & Davidson, 2004; Gross & Thompson, 2007; Hartley & Phelps, 2009; Inzlicht & Schmeichel, 2012; Johns et al., 2008; Lazarus & Folkman, 1984; Mauss, Bunge, & Gross, 2007; Williams, Bargh, Nocera, & Gray, 2009).

Fear regulation strategies. Confronted with unwanted and disturbing thoughts or undesirable feelings, individuals can choose from a wide range of regulation strategies. They engage in largely unconscious processes such as denial (Bargh et al., 2001; Gross, 1999) or consciously apply strategies such as suppression (Sarason, 1984, 1988). Other examples of regulation strategies consist of reappraisal, attention deployment, distraction, and the inhibition of facial expressions and behavioral impulses (Gross, 1998; Hartley & Phelps, 2009; Logel et al., 2009; C. T. Miller & Kaiser, 2001; Phelps et al., 2004). The term *suppression* is often used to describe how individuals override their affective states (S. Freud, 1915/1957) or inhibit their facial expressions (Gross & Levenson, 1993) or thoughts (Wegner, 1994). *Reappraisal* is a fear regulation strategy that people apply to reinterpret the fear-inducing situation and to decrease the intensity of their emotional responses (e.g., Gross, 2008;

Lazarus, 1991). Moreover, it is the most intensely investigated cognitive strategy that individuals apply to regulate fear (Lazarus & Folkman, 1984; Ochsner & Gross, 2008; Richards & Gross, 2000; Scherer, 2005). Individuals might change the appraisal of an upcoming task, reconstruct it as challenging rather than threatening (Tomaka, Blascovich, Kibler, & Ernst, 1997), or reinterpret it as less relevant and less significant (e.g., Beck et al., 1985; Phelps et al., 2004; Scherer, 1984). For example, individuals can reinterpret a medical treatment as healing rather than threatening and potentially painful (Lazarus & Alfert, 1964).

Besides changing how they think about a fear-inducing situation, individuals can shift the focus of their attention to diminish an undesired emotion (Hartley & Phelps, 2009). According to socioemotional selectivity theory (Carstensen, Fung, & Charles, 2003), *attention allocation* is a common fear-regulation strategy. Individuals shift their focus away from threatening stimuli toward positive stimuli (Mather & Carstensen, 2005; Pruzan & Isaacowitz, 2006) or toward the current goal (Duval & Wicklund, 1972; Ochsner & Gross, 2005; Rothbart & Sheese, 2007; Rusting & Nolen-Hoeksema, 1998).

Stimulus-specific regulation. The theoretical assumptions and findings reported above suggest that threatening situations automatically evoke fear responses, such as aversive thoughts and feelings, and lead to behavioral impulses. These unpleasant states activate a chain of regulation attempts consisting of various fear regulation strategies that people automatically or deliberately employ. The particular strategy people employ to regulate fear differs depending on the fear-eliciting stimulus as different stimuli produce diverse fear responses and have different regulation requirements. Owing to the diversity of fear-eliciting stimuli, there is no general framework that could predict or describe the exact regulation process for all stimuli (LeDoux, 1995; Öhman & Mineka, 2001). Thus, the stimuli of interest for the

present work will be outlined briefly below.

The present work was focused on threats that are relevant in *real life*. The most common sources of fear in real life and in the work context are self-threatening situations (Redman & Sanson-Fisher, 1989; Zeidner, 1998), whereas being involved in an armed robbery, being bitten by a poisonous spider, or being afraid of a possible nuclear war are less common sources of fear in peoples' daily lives (Öhman & Mineka, 2001).

Due to the high prevalence of self-threatening stimuli, these stimuli have become popular in several lines of research. Self-threatening situations are any situations that elicit fear of social evaluation (Zeidner, 1998) or situations that arouse the fear motive (Elliot, 1997; McClelland et al., 1953). In particular, within this category of self-threatening situations, situations in which there is a possibility of interpersonal rejection are the most powerful for inducing fear (Bowlby, 1969, 1973; Stevens & Fiske, 1995).

Studies have shown that the affective, cognitive, and behavioral determinants and responses induced by self-threatening cues are distinguishable from those induced by other fear-inducing stimuli (Bradley & Lang, 2000; Mauss, Evers, Wilhelm, & Gross, 2006). For example, Heatherton, Herman, and Polivy (1991) demonstrated that compared with self-threatening stimuli, physical threats, horror films, general threats, and distress had a negligible effect on impulsive behavior, such as resisting tempting food.

Self-threatening situations like other fear-inducing situations have been found to lead to an intense elevation of state fear and a host of fear responses, primarily worrisome and distracting thoughts (e.g., Beilock, Rydell, & McConnell, 2007; Johns et al., 2008; Schmader & Johns, 2003; Zeidner, 1998, 2007), physiological stress, and behavioral responses (Ben-Zeev, Fein, & Inzlicht, 2005). They induce an immediate

regulation tendency to minimize self-awareness by shifting attention away from the fear-inducing stimulus (Carver & Scheier, 1981; Vallacher & Wegner, 1985).

Research tradition on emotion and fear regulation. The research on emotion regulation has a long tradition. It has its origins in descriptive studies on psychodynamic mechanisms of psychological defenses (S. Freud, 1926/1959) and was continued in the 1960s with empirical work on stress and coping (Lazarus, 1966). This work inspired developmental studies on children's ability to self-regulate (Mischel, 1974; Mischel, Shoda, & Rodriguez, 1989), which provided a framework for current research on emotion regulation (Gross & Levenson, 1993; Gross & Thompson, 2007; Izard, 1990). Nevertheless, systematic research on emotion regulation is still a relatively new topic (S. Cohen & Janick-Deverts, 2012; Gross, 2008).

Even when individuals down-regulate fear by employing regulation strategies (Eagly & Johnson, 1990), theories about limited resources state that the regulation of the self is resource demanding (e.g., Baumeister et al., 1998; Mischel, 1974). Regulation is believed to rely on a limited amount of self-control that becomes depleted through subsequent regulation attempts (e.g., Muraven, Tice, & Baumeister, 1998). A review of this self-control-depleting regulation is provided in the following sections. Notwithstanding the focus of scientific effort across various fields to examine the depletion of self-control, and despite a vast number of studies that have been conducted to identify which situations or processes lead to self-control depletion (see Hagger et al., 2010, for a review), the effects of fear regulation have not yet been investigated in detail.

Even though some theorists have proposed that emotion regulation (e.g., Baumeister et al., 1998; Tice & Bratslavsky, 2000) and fear regulation in particular (e.g., Kehr, 2004d) might rely on self-control, relatively little research has attempted to investigate the depleting effects of emotion regulation (Richards & Gross, 2000).

In particular, the question of whether fear regulation taxes self-control awaits experimental investigation. The serious consequences of self-control depletion will be outlined below.

Introduction to Self-Control

Self-control is one major function of the human self (Baumeister, Heatherton, & Tice, 1994; Baumeister, Schmeichel, & Vohs, 2007). Different lines of research have delivered frameworks and theories of self-control and have used different labels to describe it. Labels such as *action control* (Kuhl, 1999), *central executive resource* (Kahneman, 1973), *central executive system* (Baddeley, 1986), *ego control* (Block & Block, 1980), *executive resource* (Engle & Kane, 2004; Norman & Shallice, 1986), *motivational skill* (Kanfer & Heggestad, 1997), *self-control resource* (Baumeister, Gailliot, DeWall, & Oaten, 2006), *self-discipline* (Duckworth & Seligman, 2005), *self-regulation* (Baumeister et al., 1998; Carver & Scheier, 1998; Kuhl & Fuhrmann, 1998), *volitional resource* (Inzlicht & Kang, 2010), *volitional strategies* (Kuhl, 1985, 1999), *volitional strength* (Kehr, 2004c), or *willpower* (Metcalfe & Mischel, 1999; Mischel, 1996) are, with the exception of some minor differences (see Hagger et al., 2010, for a review), equivalent to *self-control*, which is the term most frequently used in the current literature (Schmeichel, Harmon-Jones, & Harmon-Jones, 2010).

Despite their use of different labels, most authors generally agree that individuals benefit from having a certain amount of self-control at their disposal. Self-control enables individuals to deliberately control their impulses or reflexive and automatic responses (Barkley, 1997; Baumeister, Schmeichel, & Vohs, 2007; Fujita & Han, 2009; Higgins, 2001; Muraven & Baumeister, 2000). Without self-control, individuals would engage in automatic behavior guided by desires, temptations, attractive distractions, bad habits, and the desire for immediate gratification (Metcalfe & Mis-

chel, 1999; Mischel, 1974; Mischel et al., 1989; Muraven et al., 1998; Verplanken & Faes, 1999). Self-control enables individuals to alter or to suppress their dominant response in order to choose a less common but more desired response that will contribute to more productive behavior (Bandura, 1989; Fishbach & Labroo, 2007; Kashdan & Rottenberg, 2010; Loewenstein, 1996; Logan & Cowan, 1984; Rothbart, 2007; Swann, Bjork, Moeller, & Dougherty, 2002; Vohs & Baumeister, 2011). In sum, self-control helps to orchestrate goal-oriented behaviors (e.g., Inzlicht & Kang, 2010; Schlam, Wilson, Shoda, Mischel, & Ayduk, 2013).

Furthermore, self-control is needed to succeed at novel (Engle & Kane, 2004; Norman & Shallice, 1986) and difficult tasks (Muraven & Baumeister, 2000). More importantly, self-control gets depleted when it is exerted to accomplish tasks that require self-control to be completed. I use the terms *self-control depletion* or *depletion* to refer to the state characterized by a reduction in the amount of the resource of self-control immediately following the exertion of self-control.

Many theories that predict the depletion of self-control have been proposed (e.g., Baumeister & Vohs, 2004; Gross, 1998; Hofmann, Schmeichel, & Baddeley, 2012; Kehr, 2004d; Kuhl, 1985). As the present research focused in particular on the effects of fear regulation on self-control, in the following sections, I consider two more recent theories of self-control that view fear regulation in the context of the limited self-control resource model. To begin, I will introduce the compensatory model of work motivation and volition (Kehr, 1999, 2000, 2004c, 2004d), which concerns the response conflict between fear-induced impulses and the actual goal. Next, I will introduce the strength model of self-control (Baumeister et al., 1998; Muraven et al., 1998), which focuses primarily on self-control as a *limited resource* and predicts its depletion. Although it is beyond the scope of this work to deliver an exhaustive report on both theories, key elements will be reported to provide a detailed foundation

on which the hypotheses and the studies in the present work were built.

The compensatory model of work motivation and volition. The compensatory model of work motivation and volition (Kehr, 1999, 2000, 2004c, 2004d) offers a comprehensive framework for how fear depletes self-control, integrating self-regulation processes into a larger context of motivation. It amalgamates previous theories of self-control, classical motivational psychology, and concepts of work motivation. The core concept of the compensatory model of work motivation and volition (hereafter referred to as the *compensatory model*) is that the interaction between aroused motives and actual goals leads to different motivational states. For example, intrinsic motivation occurs if the aroused motive and the goal are congruent; and insufficient motivation results if the aroused motive and goal are conflicting. The distinction between motives and goals is in line with other dual-system theories that postulate an emotional system and a cognitive system (Strack & Deutsch, 2004). *Goals* are determined by social norms and demands (e.g., Koestner, Weinberger, & McClelland, 1991; McClelland, 1995) and are consciously represented as future states (e.g., Gollwitzer & Moskowitz, 1996; Locke & Latham, 1990). *Motives* are assumed to be independent of social norms and are not necessarily consciously represented (McClelland, 1995). The most common motive classification system differentiates between the *power*, *achievement*, and *affiliation* motives (e.g., McClelland, 1995). Motives are further subdivided into *hope* and *fear* components. Unlike the hope component, which consists of the power, achievement, and affiliation motives, fear has been found to be an overall factor in most studies (Langens & Schmalt, 2002; Sokolowski, Schmalt, Langens, & Puca, 2000). Thus, I refer to the fear motive as one motive without further differentiation.

The main prediction stated by the compensatory model is that self-control is needed in particular to act against incongruent or conflicting responses activated by

the aroused fear motive and responses activated by the actual goal—for example, to perform a task well (Kehr, 2004c, 2004d). Fear-activated responses, originally intended to prevent negative outcomes, might interfere with an actual goal and lead to an *intrapersonal* conflict (Carver, 2004; M. W. Eysenck & Calvo, 1992; Gross & Thompson, 2007; Kanfer & Heggestad, 1997; Kuhl & Goschke, 1994; McClelland, 1985; Rosenbaum, 1998; Ryan, Sheldon, Kasser, & Deci, 1996; Sarason, 1984; Sokolowski, 1993; Wood et al., 2001). An exemplary intrapersonal conflict in everyday life is a situation in which a person feels anxious about an upcoming exam and at the same time aims to obtain a good grade and has to prepare for the exam. Another example of an intrapersonal conflict occurs when an employee considers negotiating a raise but faces the possibility of rejection; his or her goal of earning more money conflicts with negative affective states and intrusive thoughts originating from the aroused fear motive.

The compensatory model states that individuals who face an intrapersonal conflict switch into the *volitional mode*, in which they engage in self-control to overcome fear-induced impulses and to support the actual goal. This follows Kanfer and Heggestad's (1997) proposition that both *suppressing fear-induced tendencies* and *supporting goal-striving behaviors* are functions of self-control. The postulation that an intrapersonal conflict demands volitional regulation is consistent with classical cognitive self-control theories, which propose that regulation is an effortful process that is needed to overcome distracting impulses, emotions, desires, habits, or other responses (Carver & Scheier, 1982, 1990; Higgins, 1996).

This volitional conflict regulation process is further outlined in the cybernetic model (Carver & Scheier, 1981), according to which regulation relies on monitoring and operating systems (Carver & Scheier, 1981; Wegner, 1994). The monitoring system detects the conflict by comparing the ongoing fear response to the intended

goal-directed response (Carver & Scheier, 1981, 1991). The operating system empowers goal-approach attempts while suppressing the incompatible fear-induced response (Macrae, Bodenhausen, & Milne, 1998). Similarly, the model of the central executive system (Baddeley, 1986; Baddeley & Hitch, 1974) proposes two separate regulation systems, both of which rely on one unique executive resource. The *storage system* processes task-related information and the *executive system* empowers behavior. Analogously, neuroscientists have identified two separate neural systems, one responsible for monitoring and error detection and one for regulation (e.g., Holroyd & Coles, 2002; Johns et al., 2008).

To further elucidate these mechanisms of emotion regulation, early concepts of self-control focused on cognitive factors such as attention (Carver & Scheier, 1981, 1982; Richards & Gross, 2000), suggesting that emotion regulation depends on a *finite amount of attentional resources*. For example, attentional control theory (M. W. Eysenck et al., 2007) states that fear disrupts goal-directed behavior by drawing attention toward fear-inducing stimuli and away from the actual goal (Ellis & Ashbrook, 1989; M. W. Eysenck, 1992). While effortfully deploying attention, people might inhibit the fear-induced shift of attention and focus on the actual goal (Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998). However, further attention would be necessary to constantly monitor the conflict between the fear stimuli and one's actual goals as the two compete for one's limited attentional resources. Research into processing efficiency has provided evidence that fear-induced intrusive thoughts and worries also undermine attentional resources and their limited capacity (which is needed to perform the ongoing cognitive task; M. W. Eysenck & Calvo, 1992; Kahneman, 1973). Unfortunately, research into processing efficiency has been conducted exclusively on participants with generalized anxiety disorder rather than by testing the effects of induced fear.

More recent studies have shown that stimulus-driven impulses and goal-directed tendencies appear to compete in particular for limited attentional resources (Knudsen, 2007). Individuals who were exposed to a threat were less able to monitor their goals and goal-directed performance compared with individuals who were not exposed to a threat (Moser, Hajcak, & Simons, 2005). Even though these studies have established a relation between anxiety and attention-based self-control, this relation has been demonstrated only for performance on simultaneously conducted cognitive tasks.

Other studies across different fields have shown that a large amount of attentional resources are essential for successful regulation. People good at focusing attention while ignoring distractions were also good at other cognitive tasks, such as logical reasoning (Kane et al., 2004) or decision making (e.g., Hinson, Jameson, & Whitney, 2003). In general, attention regulation is assumed to be a key mechanism in self-control (Engle & Kane, 2004; Knudsen, 2007; Norman & Shallice, 1986; Schmeichel, 2007), and attention control is a key volitional strategy (e.g., Kehr, 2004b; Kehr & von Rosenstiel, 2006; Kuhl, 1985, 1999).

Besides *attention control* (Atkinson & Birch, 1970; Egeth & Yantis, 1997; James, 1890/1981; Norman & Shallice, 1986), the compensatory model proposes further key self-control strategies, such as *motivation control* (Lewin, 1927; Martin & Tesser, 1996; Mischel, 1996; Oettingen, Pak, & Schnetter, 2001), *emotion control* (Bagozzi & Pieters, 1998; Forgas, Johnson, & Ciarrochi, 1998; Gross, 1999; Josephson, 1996), and *decision control* (Jostmann & Koole, 2007; Koole & van Knippenberg, 2007). Kehr (2004c, 2004d) also incorporated the notion of a limited self-control resource (Baumeister et al., 1998) into the compensatory model. This self-control becomes temporarily depleted with use and results in a decrease in the ability to control further behavior (Baumeister, Schmeichel, & Vohs, 2007; Kross & Mischel, 2010; Schmeichel, 2007; Tice et al., 2001; Ward & Mann, 2000).

Self-control as a limited and general resource. The strength model of self-control (Muraven et al., 1998) extends previous concepts of self-control from cognitive capacity to the amount of bodily energy that individuals have at their disposal. It posits that self-control is a highly adaptive inner resource that can be used for diverse regulative actions (Baumeister & Heatherton, 1996; Baumeister, Vohs, DeWall, & Zhang, 2007; Muraven & Baumeister, 2000). Like cognitive capacity models, the strength model of self-control proposes that all regulation attempts rely on self-control (e.g., Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001; Johns et al., 2008; Muraven et al., 1998). Consequently, all acts of self-control draw from a *general resource* that they subsequently deplete (Baumeister, Schmeichel, & Vohs, 2007). Depending on previous efforts, any individual has more or less self-control available (self-control depletion); thus, he or she is more or less likely to succeed at self-regulation at certain times (Baumeister et al., 2006).

The fundamental assumption that self-control *fluctuates over time* is an outgrowth of the earlier work by Gestalt psychologists Lewin (1928), Zeigarnik (1927/1967), Feather (1961), Atkinson and Cartwright (1964), and Atkinson and Birch (1970), who assumed that variables such as persistence and latency could be integrated into a framework of actions over time. As a metaphor for fluctuating self-control, Baumeister and his colleagues proposed that self-control becomes tired with use like a muscle (Baumeister, Schmeichel, & Vohs, 2007).

Viewing self-control as a general, limited, and fluctuating resource explains a broad variety of empirical findings, which have shown that one act of self-control leads to a deterioration in performance on subsequent self-control tasks in different domains. This phenomenon of the subsequent breakdown of self-control across different domains was labeled the *spillover effect* (Baumeister et al., 2006). To provide an empirical test for the spillover effect, most recent research has applied the *dual-task paradigm* (e.g.,

Baumeister & Vohs, 2007), which clearly differs from the procedure formerly used to identify cognitive determinants of multitask coordination for which people worked on two tasks simultaneously (Baddeley, 1986). Instead of using two self-control tasks simultaneously, the dual-task paradigm relies on two subsequent self-control tasks. Performing one self-control-demanding task undermines performance on subsequent self-control-demanding tasks (Baumeister, Vohs, & Tice, 2007; Finkel et al., 2006). Baumeister et al. (1998) conducted one of the pioneering studies on the spillover effect. They showed that participants who forced themselves to eat radishes while ignoring chocolate chip cookies performed worse on a subsequent self-control task.

Restoring depleted self-control. The strength model of self-control states that depleted self-control can replenish itself after a period of rest or through relaxation, just as muscles require a period of recovery after exertion before they can apply further force (Baumeister & Heatherton, 1996; Tyler, 2008). Recovery periods have been shown to help people regain self-control and to counteract the depleting effects of previous self-control exertion on a subsequent self-control task (Baumeister & Heatherton, 1996; Couyoumdjian et al., 2010; Muraven & Baumeister, 2000). Self-control-depleted individuals who were given the opportunity to rest performed better on the subsequent self-control task than depleted control subjects who were not given the opportunity to rest (Oaten, Williams, Jones, & Zadro, 2008; Tyler, 2008).

Glucose supplementation has been proposed as a possible mechanism behind fluctuating self-control (Gailliot et al., 2007; Inzlicht & Schmeichel, 2012). Some studies have shown that boosting the blood glucose level can increase performance on tasks that require divided attention (Sünram-Lea, Foster, Durlach, & Perez, 2002). Depleted participants who consumed a glucose drink seemed to replenish their self-control and performed better on the subsequent self-control task than the control

group (Gailliot et al., 2007; Inzlicht & Schmeichel, 2012). Sanders, Shirk, Burgin, and Martin (2012) as well as Hagger and Chatzisarantis (2012) reported contradictory results on the role of glucose in the depletion process. These latter two research groups showed that a mouth rinse with the glucose-containing drink and not the restoration of the low glucose level itself led to the replenishment of self-control.

Even though the exact mechanisms behind self-control depletion and recovery are not yet fully understood, numerous studies have shown that overriding dominant responses leads to a deterioration in subsequent self-control-tasks performance (e.g., Baumeister & Heatherton, 1996; Eder, Rothermund, & Proctor, 2010; Govorun & Payne, 2006; Hofmann, Friese, & Strack, 2009; Inzlicht, McKay, & Aronson, 2006; Logan, Schachar, & Tannock, 1997; Ward & Mann, 2000). In the following section, I will focus on fear-regulation strategies that people use to override fear and that are assumed to cause deterioration in self-control. A brief report on studies conducted on fear regulation is also included.

Fear Regulation and Self-Control: Overlaps in the Research

The impact of fear on cognitive performance. Superficially considered, fear itself does not automatically lead to decreased performance (M. W. Eysenck & Calvo, 1992). As outlined above, due to its survival function, fear activates avoidance impulses that energize avoidance behavior (Atkinson, 1964; Bowlby, 1969; Carver, 2001; Covington & Omelich, 1991; Elliot, 1997; H. J. Eysenck, 1967; Gray, 1994; H. Heckhausen, 1963; J. Heckhausen & Heckhausen, 2008; Heider, 1958; Higgins, 1998; Hull, 1943; Lewin, Adams, & Zener, 1935; Maslow, 1955; McClelland et al., 1953; Tamir & Ford, 2009). For example, if one's survival depends on escaping a dangerous situation, such as leaving the house during a fire, fear facilitates a fast escape (M. W. Eysenck & Calvo, 1992). There are occupations that actually depend

on and benefit from avoidance-driven behavior, such as air traffic controllers, whose goal is to keep airplanes from crashing.

Besides these behavioral impulses that occur under the influence of fear, individuals also tend to experience worry, which usually elevates their effort on the actual task. Driven by the motivation to avoid undesirable outcomes or consequences, individuals continue working with increased effort on tasks that induce fear (Elliot, 2006; Ferrari & Tice, 2000; Seibt & Förster, 2004; Spokas, Rodebaugh, & Heimberg, 2007). This elevated effort can prevent performance from declining (Elliot, 2006). Subsequently, due to this increase in effort, the performance quality of a simple task might even improve (Calvo & Alamo, 1987; L. W. Morris, Kellaway, & Smith, 1978; D. A. Weinberger & Singer, 1990), but its efficiency might decline as more attention and effort are allocated to the fear-inducing task (Baumeister, Vohs, DeWall, & Zhang, 2007; Cury, Elliot, Da Fonseca, & Moller, 2006).

Taken together, individuals under the influence of fear deliver the same performance as people in a neutral state as long as they have enough resources at their disposal to apply compensatory strategies to counteract fear and to enhance effort (Wood et al., 2001). Individuals suffering from depleted self-control, on the other hand, are less able to down-regulate their thoughts and affective states (Bertrams, Englert, & Dickhäuser, 2010; Gailliot, Schmeichel, & Baumeister, 2006; Wood et al., 2001).

Despite the fact that fear-induced avoidance impulses can energize behavior, research on motivation has neglected avoidance motivation, principally due to the fact that approach motivation is more efficient in terms of goal achievement (Birney, Burdick, & Teevan, 1969; Elliot & Harackiewicz, 1996; Elliot et al., 1997; H. Heckhausen, 1975; Lewin et al., 1935; Murayama, Elliot, & Yamagata, 2011; Robinson, Wilkowski, & Meier, 2008) and is thus of greater interest to many researchers (e.g.,

Atkinson, 1957, 1964; Carver, 2005; Carver & Scheier, 1981, 1991; Elliot et al., 1997; H. J. Eysenck, 1967; H. Heckhausen, 1963, 1991; Heider, 1958; Higgins, 1997, 1998; Lewin et al., 1935; McClelland et al., 1953; Spokas et al., 2007). In general, avoidance motivation is problematic because it exerts a pervasive and automatic influence on behavior (Elliot, 2006). Individuals utilize avoidance motivation automatically, even in the absence of objective danger (Elliot, 2006; Epstein, 1972). Furthermore, people experience avoidance motivation as stressful. Stress diminishes not only task enjoyment, but, if overused, it could also lead to a deterioration of general well-being in the long run (Elliot, 2006; Elliot & Sheldon, 1998; Elliot et al., 1997). This long-term effect has been observed in studies of professions that rely on permanent avoidance behavior, such as air traffic controllers. Staff turnover rates have been found to be extremely high among air traffic controllers (Elliot & Sheldon, 1998; Elliot et al., 1997; Hopkin, 1995). Moreover, fear motivates individuals to avoid and to escape particular fear-inducing situations and leads to negative consequences such as a missed opportunity to receive a degree or to get a job. Thus, avoidance motivation could also result in a reduction in self-esteem and material losses. Of particular concern are threatening situations that lead to conflicts between simultaneously (or nearly simultaneously) activated avoidance and approach tendencies. These are assumed to result in the deterioration of performance and achievement (Higgins, 1997). Lewin et al. (1935) used the spatial metaphor to describe this approach-avoidance conflict (Hovland & Sears, 1938; N. E. Miller, 1944). If not regulated, such a conflict can interrupt a person's movement toward the actual goal as these two directions of movement are incongruent with each other; thus, the system becomes "paralyzed" by indecision (Neumann, Förster, & Strack, 2003; Robinson et al., 2008).

Emotion regulation from the self-control perspective. Baumeister, Schme-

ichel, and Vohs (2007) emphasized the importance of emotion regulation as the central subject of self-control because, unlike the regulation of impulses (e.g., resisting the urge to gamble), emotion regulation is relevant for all individuals. In particular, the regulation of fear is a central component in the regulation of emotions because everyone experiences fear from time to time and must occasionally attempt to down-regulate it.

Research in the field of fear has mostly considered the ramifications of fear for more general cases, such as personal adjustment and well-being, rather than its effects on self-control. The basic association between fear and losses in self-control has mainly been shown to be a byproduct of research on trait anxiety (Endler, 1980; M. W. Eysenck, 1997; Kantor, Endler, Heslegrave, & Kocovski, 2001), which is an extraordinarily large field of research due to the fact that anxiety disorders affect between 13% and 19% of the entire population across the lifespan (Narrow, Rae, Robins, & Regier, 2002; Waraich, Goldner, Somers, & Hsu, 2004). Trait anxiety is associated with failures in impulse control, such as alcohol and substance abuse, and a variety of other self-control failures (Goldin, McRae, Ramel, & Gross, 2008; Gross & Thompson, 2007; Gunnar & Donzella, 2002; Hartley & Phelps, 2009; Mauss et al., 2006, 2005; Mullaney & Trippett, 1979; Smail, Stockwell, Canter, & Hodgson, 1984). High trait anxiety is related to low academic achievement (Elliot & Church, 1997), physical illness such as asthma and coronary heart disease (Edelmann, 1992; Suinn, 2001), low self-esteem (Hamm, 1977; Lanaj, Chang, & Johnson, 2012), job dissatisfaction (Lanaj et al., 2012), and impaired subjective well-being (Elliot, 1997). For example, one empirical study showed that the regulation of threatening thoughts depends on self-control from the cognitive sphere (Wood et al., 2001). Participants performed two simultaneous tasks. One task was to inhibit meanings of ambiguous words that could be interpreted as threatening or

neutral. Previous research has shown that participants high in trait anxiety perceive ambiguous words as threatening, whereas nonanxious participants perceive them as neutral (e.g., Derakshan & Eysenck, 1998; Sorg & Whitney, 1992). While inhibiting the meaning of ambiguous words, individuals high in trait anxiety performed worse on simultaneous cognitive self-control tasks than nonanxious individuals (Wood et al., 2001). The authors interpreted this finding to mean that the people high in anxiety (vs. the nonanxious people) were involved in an additional task: They were suppressing the threatening thoughts that were aroused by the ambiguous words that they perceived as threatening. The suppression of threatening thoughts competes with other cognitive tasks and produces an additional cognitive load.

Nevertheless, focusing on differences in individual trait anxiety neglects the situational effects of fear on self-control that are relevant for each individual whatever their anxiety disposition. As self-control is necessary for regulating various behaviors, the self-control-depleting effects of fear should have important implications for many spheres of life and on work performance in particular. Moreover, as self-control is defined as a limited and general resource that remains depleted for a period of time, fear should lead not only to a simultaneous depletion but also to a *subsequent depletion* in attempts at self-control. Studies on trait self-control such as the aforementioned investigation by Wood et al. (2001) have exclusively examined performance on two simultaneous task. On the other hand, studies that have investigated the effects of fear have focused primarily on the affective consequences of fear regulation. More precisely, they have investigated how effective people are at suppressing fear-induced affective responses (DePaulo, Blank, Swaim, & Hairfield, 1992; Richards & Gross, 2000; Wegner, Erber, & Zanakos, 1993). The fact that regulation, whether effective or not, could have side effects and could possibly deplete self-control was not of interest to these researchers when they conducted this previous research. The present

research takes matters a step further and closes this gap by investigating the side effects of fear, or more precisely, whether fear regulation depletes people's limited self-control. Before further outlining the main research hypothesis, fear regulation strategies and empirical findings on regulation strategies as well as the limitations of previous research will be reviewed.

Research on the effects of fear regulation on self-control. Studies across many areas of psychology have led to an understanding of the basic processes and strategies involved in fear regulation. Fear leads to the array of automatically and deliberately regulated processes and responses outlined above. Fear regulation comprises several strategies, most of which, when viewed individually, are presumed to be effortful and thus rely on self-control (e.g., Gross, 1998). Ideally, individuals can regulate fear when confronted with a goal that differs from the fear-induced impulse; but this regulation might be costly. The general proposition in the literature is that repairing negative moods or overriding intrusive thoughts requires effortful regulation (Hockey, 1984; Richards & Gross, 2000; Wegner, 1994). Furthermore, as this regulation relies on the resource of self-control, which is limited and becomes depleted with use, subsequent regulation attempts are likely to fail (Baumeister, Faber, & Wallace, 1999; Inzlicht & Kang, 2010).

Suppression. The earliest concept of affect and thought regulation is *suppression* (A. Freud, 1936/1958; N. M. Weinberger, 1995), which describes the intentional regulation mechanism that underlies the regulation. As outlined previously, individuals are motivated to exclude intrusive thoughts and negative emotions from their awareness if they are incompatible with the ideal self (S. Freud, 1930/1961). Freud postulated that to maintain such a regulation, people have to expend "psychic energy" (S. Freud, 1930/1961). This idea is reapplied in the theory of ironic processes of mental control by Wegner (1994, 2009), as well as by the model of cognitive changes

(Salovey, Detweiler-Bedell, et al., 2008), suggesting that a negative experience will continue to challenge one's thoughts until it is resolved and is no longer something that needs to be avoided.

Similarly, the theory of ironic processes of mental control posits that suppression initiates the shift of attention away from the unwanted thought but is accompanied by an ironic monitoring process, which ensures that the unwanted thoughts remain outside of awareness. Ironically, the monitoring process promotes the reoccurrence of the very thought, other intrusive thoughts, or even unwanted behavior (Wegner & Pennebaker, 1993). Furthermore, the monitoring process itself operates like an act of self-control, causing insidious cognitive load and leading to distress (Gailliot et al., 2006; Najmi, Riemann, & Wegner, 2009; Newman, Duff, & Baumeister, 1997; Wegner & Erber, 1992). The dynamics of action theory (Atkinson & Birch, 1970) posits in more general terms the idea that behavioral impulses persist until they are satisfied, as an interpretation of Newton's first law of motion—"the law of inertia"—postulating that a body in motion will remain in motion unless acted upon by an unbalanced force (Newton, 1726/2010). Research has shown that affective states, unwanted thoughts, and behavioral impulses remain present even though individuals attempt to suppress these affective states, thoughts and impulses as soon as they arise. Moreover, the suppression is neither effective nor cost free (Clark, Purdon, & Wang, 2003; Kanfer & Heggestad, 1997; Puca & Schmalt, 1999; Rachman & De Silva, 1978). Studies that have measured the simultaneous performance of a cognitive task while the participant was in a state of worry have shown that simultaneous cognitive tasks were performed less efficiently than in the worry-free control condition (Asendorpf & Scherer, 1983; Humphreys & Revelle, 1984; Lane, Kivley, Du Bois, Shamasundara, & Schwartz, 1995; Revelle & Loftus, 1990; Shedler, Mayman, & Manis, 1993; Vaillant & McCullough, 1998; N. M. Weinberger, 1995). Based

on this and similar findings, limited resource theories propose that any action that depends on suppression, inhibition, or attention control depends on self-control and thus depletes this resource (Baumeister et al., 1998; Hofmann et al., 2009; Logan et al., 1997).

Mood repair. Fear regulation might deplete self-control when individuals undertake the effort to *repair* their *mood* (Vohs & Baumeister, 2011). As outlined above, individuals automatically engage in effortful attempts to repair their mood when they experience negative affective states (e.g., Bruyneel et al., 2009).

Abundant research has suggested that a bad mood leads to failures in impulse control. It has been shown to hamper the delay of gratification (Tice et al., 2001), to cause procrastination (Scher & Ferrari, 2000), and to lead to increased food consumption in dieters (Greeno & Wing, 1994; Slochower & Kaplan, 1980), thereby indicating losses in self-control.

In several studies in which participants were instructed to suppress their negative affective states, this suppression depleted their self-control (e.g., Bruyneel et al., 2009; Muraven & Baumeister, 2000; Vohs & Baumeister, 2011). In one exemplary study that applied the dual-task paradigm, participants were instructed to suppress any emotions they experienced while watching an emotional film. Participants who were instructed to suppress their emotions gave up more quickly on a subsequent handgrip-squeezing task compared with control subjects who were not asked to suppress their emotions (Muraven et al., 1998). In another emotional-film-viewing study, participants who were instructed to suppress their emotions solved fewer word puzzles afterwards compared with nonsuppressing control subjects (Baumeister et al., 1998).

Suppression of automatic facial expressions. A similar empirical pattern in the studies on mood repair has been provided by investigations on the suppression of facial expressions. These studies consistently showed that deliberate attempts to

overcome one's *automatic facial expressions* require effort and deplete self-control. In these studies, individuals who were instructed to suppress their facial expressions seemed to expend their self-control on this suppression. They performed worse on a subsequent self-control task compared with the nonregulating control group (Arndt, Greenberg, Solomon, Pyszczynski, & Simon, 1997; Baumeister et al., 1998; Bruyneel et al., 2009; Greenberg et al., 1994; Gross & Levenson, 1997; Schmeichel, 2007; Yi & Baumgartner, 2004). In one characteristic study on expressive suppression, participants were instructed not to show any visible signs of emotions while watching an emotional film (Schmeichel, Vohs, & Baumeister, 2003). After suppressing their expressions, participants performed significantly worse on a subsequent test comprising difficult logic problems compared with the nonsuppressing control subjects. Similarly, participants whose self-control was previously depleted were less able to regulate their facial expressions compared with the nondepleted control subjects (Muraven et al., 1998). In another study, participants were instructed to exaggerate their expressions: Those who did so performed worse on a subsequent working memory test compared with participants in the nonexaggerating condition (Schmeichel, 2007). Gross and Levenson (1993) demonstrated that the instructed suppression of both negative and positive facial expressions in response to sad and amusing films decreased self-reported enjoyment and elevated sympathetic activation of the cardiovascular system. Richards and Gross (2000) further showed that participants who were instructed to suppress their facial expressions while viewing the film remembered fewer details compared with the control group.

Instructed suppression of negative thoughts. A similar empirical pattern has been found in investigations of the *instructed suppression of negative thoughts*. Studies have demonstrated that instructed suppression of worrisome and intrusive thoughts is resource demanding and leads to later losses in self-control (Gordijn,

Hindriks, Koomen, Dijksterhuis, & Van Knippenberg, 2004; Logel et al., 2009; Muraven et al., 1998; Richards & Gross, 2000; Wegner, 1994). Suppressing negative thoughts has been found to result in aggressive responses (DeWall, Baumeister, Stillman, & Gailliot, 2007), an overuse of heuristics in decision-making processes (Masicampo & Baumeister, 2008), problems resisting tempting food (Vohs & Heatherton, 2000), and difficulties concentrating on a task (Inzlicht & Gutsell, 2007). Gailliot et al. (2006) showed in a series of studies that participants who were instructed to suppress thoughts about their own mortality performed worse on the subsequent self-control task than control subjects. They also showed that participants with depleted self-control were less successful at coping with mortality-related thoughts compared with nondepleted participants. Studies on stereotypes have provided similar results, showing that participants who were told that they had been stereotyped and were then instructed to suppress stereotype-induced thoughts of shame and frustration performed less efficiently on subsequent self-control tasks compared with the control group (Inzlicht & Gutsell, 2007; Schmader & Johns, 2003; Schmeichel, 2007).

Limitations of the Research on Emotion Regulation and Self-Control

The notion that fear regulation might deplete self-control is not novel, and several lines of research have suggested that regulation attempts that usually follow fear tend to deplete self-control. Despite providing quite encouraging results, these studies have clear limitations, which are outlined below. To provide compelling evidence that fear regulation relies on self-control and depletes it, the current research aims to overcome the limitations of previous studies.

Instructed regulation. In almost all studies conducted on emotion regulation and in all studies on the regulation of negative emotions, participants have been *instructed to suppress* thoughts, affective states, or emotional expression (e.g., Muraven

et al., 1998; Richards & Gross, 2000). Thus, it is not possible to conclude from the existing studies on instructed regulation whether noninstructed fear regulation leads to the depletion of self-control. Compared with real-life regulation, instructed regulation is affected by a person's ability, motivation, or willingness to engage in regulation. One might also argue that keeping the task instructions in mind and monitoring one's regulation success are cognitive tasks in themselves and thus could be held responsible for the depletion of self-control—rather than the regulation of the emotional responses. Furthermore, instructed regulation may hamper a person's motivation and result in lower performance on a subsequent self-control task—even if self-control is not depleted (e.g., Tice & Bratslavsky, 2000).

In general, investigating instructed regulation is hampered by the fact that people usually regulate their emotions *automatically* without the explicit intention to do so and without being instructed to do so (Bargh & Williams, 2007; Parkinson, 1999). Regulation often relies on habits—for example, not showing fear is a well-learned and appropriate reaction in public (Mauss, Cook, et al., 2007) and does not require the deliberate activation of regulation attempts (Bargh & Chartrand, 1999; Bargh & Williams, 2007; Eder et al., 2010; Fitzsimons & Bargh, 2004; Hofmann et al., 2009; Metcalfe & Mischel, 1999; Muraven & Baumeister, 2000; Robinson et al., 2008).

Koole and Jostmann (2004) as well as Mauss, Bunge, and Gross (2007) have argued that regulation processes fall on a continuum between automatic and deliberate regulation. Automatic regulation in accordance with people's habits, is held to be less effortful than deliberate regulation (Mauss et al., 2005). Thus, based on the existing studies on instructed regulation, it is not possible to conclude whether noninstructed fear regulation, which is most relevant in real life, is self-control depleting. On the other hand, studies on implementation intentions, so-called *if-then plans* (Gollwitzer,

1999; Gollwitzer, Achtziger, Schaal, & Hammelbeck, 2002), have shown that instructed regulation is not necessarily self-control depleting. Researchers have taught participants to use if-then plans to down-regulate their fears of spiders and snakes without expending their self-control (Achtziger, Bayer, & Gollwitzer, 2012; Gallo, Keil, McCulloch, Rockstroh, & Gollwitzer, 2009; Gollwitzer, 1999). In general, theories of self-control propose that noninstructed regulation is resource demanding as it is an active and effortful process that people undertake to down-regulate their fear-induced impulses (Baumeister et al., 1998; Baumeister, Schmeichel, & Vohs, 2007; Gazzaniga, Ivry, & Mangun, 1998; Kruglanski & Higgins, 2007). The current studies fill a gap in this area of research by investigating the depleting effects of noninstructed fear regulation.

Irrelevant fear-inducing stimuli. Another limitation of most previous studies is that they had examined either *general* or *specific* threats, both of which are not common in real life—such as one's own mortality (Gailliot et al., 2006), the anticipation of an electric shock (Heatherton et al., 1991), or snakes and spiders (e.g., Gallo et al., 2009). As already mentioned above, fear responses and demands for regulation differ depending on the fear-inducing stimulus (e.g., Arndt, Greenberg, & Cook, 2002; LeDoux, 1995; Öhman & Mineka, 2001). Self-control may run out during a threatening situation of long duration—for example, while preparing for an exam or while taking a test—impairing the ability to either regulate fear or to exert self-control for the remaining time (Schmeichel & Vohs, 2009). Short-term threats on the other hand—such as viewing a picture of a spider (e.g., Gallo et al., 2009)—might not tax self-control. Self-control depletion might be more likely to result from stimuli that trigger active suppression attempts more intensively than others. It is plausible that more effort is invested in suppressing thoughts about threats to one's own mortality than in suppressing the thought that one might fail an exam (e.g.,

Gailliot et al., 2006).

To date, no studies have conducted a test to investigate the self-control-depleting effects of real-life fear regulation. Therefore—as it is not possible to apply findings from previous studies, which focused on general and specific threats to real-life relevant fear-inducing situations—this work aimed to provide further evidence to close this gap.

Simultaneous assessment versus dual-task assessment. The last and a particularly important limitation is that almost all studies on emotion regulation and all studies on fear regulation have focused exclusively on *simultaneous task performance*, neglecting to demonstrate the stability of depletion effects across time—the *spillover effect*. As mentioned above, the spillover effect is a theoretically substantiated notion and an indicator of the generality of resource consumption by a particular stimulus (e.g., Baumeister et al., 1998, 2006). First, testing for the spillover effect adds the dimension of time to the self-control-depletion approach, and this is especially important to do in the applied context as previous regulation could affect later self-control attempts.

Besides the fact that it has less practical relevance, the practice of running two self-control tasks simultaneously is not necessarily the most suitable way to investigate self-control depletion: Simultaneous task accomplishment could lead to performance decreases that are not exclusively the result of depleted self-control, but may instead be due, for example, to a person's physical ability or an individual's inability to multitask (e.g., Nordin, Moe-Nilssen, Ramnemark, & Lundin-Olsson, 2010). In this work, however, I looked beyond simultaneous task performance and investigated the fear-induced spillover effect, which had not been investigated before.

The Main Hypothesis and Summary of the Theoretical Foundation

Having reviewed the main theories and studies conducted on fear regulation as well as the limitations of these studies, I will now outline the main hypothesis and explain how this research aimed to extend previous findings on self-control depletion.

The major focus of the present work was to provide an empirical test for fear-induced self-control depletion and to overcome the reported limitations of previous studies.

The main hypothesis posited that spontaneous, noninstructed fear regulation would rely on self-control and lead to subsequent self-control depletion *(Hypothesis 1)*.

This hypothesis was built on predictions made by the compensatory model and limited resource theories of self-control (Baumeister et al., 1998; Kehr, 1999, 2004c, 2004d). In terms of the compensatory model, the central prediction was that fear would activate a conflict between fear-induced and goal-related responses, and thus, individuals would engage in compensatory regulation to overcome fear and to support goal-related responses. Resolving this response conflict by regulating fear is a self-control-demanding process and was thus expected to deplete self-control (Kehr, 2004c, 2004d). According to theories of emotion regulation and limited resource models, fear activates a causal chain in which negative affective states, intrusive thoughts, involuntary expressions, and behavioral impulses compel a person to engage in fear regulation (e.g., Gross, 2008; Mischel, 1974; Schmeichel, 2007). To regulate fear, individuals apply regulation strategies such as the suppression of intrusive thoughts, affective states, and facial expressions (Johns et al., 2008; Schmeichel et al., 2003), all of which are assumed to rely on self-control (Baumeister et al., 1998; Muraven & Baumeister, 2000), which is conceptualized as a limited resource that is depleted after exertion (Muraven & Baumeister, 2000). Thus, regulating fear was expected to lead

to the depletion of this limited resource and as a result, performance on subsequent self-control tasks was expected to be diminished even if the fear-inducing stimulus was no longer present (e.g., Baumeister et al., 1998; Muraven & Baumeister, 2000; Tice & Bratslavsky, 2000; Vohs & Baumeister, 2011; Vohs, Baumeister, & Ciarocco, 2005; Vohs et al., 2008). The assumption that fear regulation depletes the general resource of self-control and results in subsequent regulation failures—the spillover effect—is unique to this research. The dual-task paradigm was a suitable framework for testing whether fear regulation would consume a general resource, spilling over into mundane, different, real-life domains even when they were unrelated to the fear-inducing situation (e.g., Baumeister et al., 1998; Finkel et al., 2006; Tangney et al., 2004).

In summary, the proposition of this research was that fear regulation would impair a number of subsequent fear-unrelated self-control tasks. Despite the broad theoretical foundation, to my knowledge, no research has examined the proposition that fear regulation depletes self-control. This research attempted to close this gap.

Introduction to the Studies

To investigate the research hypothesis, including the assumption of fear-induced depletion of limited and general self-control, I conducted seven studies. Study 1 served as a pretest to identify the most efficient method for inducing a moderate amount of fear. I compared three self-threatening situations: an announcement of an exam, an intelligence test, and a public speech. After the first study showed that the announcement of the public speech was the most efficient fear-inducing method, six experiments followed (Studies 2 to 7) to examine the depleting effect of fear on self-control *(Hypothesis 1)*.

In these six studies, I measured whether prior exposure to a threat would de-

plete self-control, leaving participants with fewer resources to perform subsequent self-control tasks from different domains of self-control. Although the experimental manipulation—announcement of the public speech—was identical across all studies, I varied the assessment of self-control to investigate the generality of the spillover effect. All studies were conducted in a laboratory setting with a control group design. I manipulated state fear by announcing the public speech task in the experimental condition and a neutral (nonthreatening) task in the control condition. I compared the postmanipulation self-control of participants in the fear-inducing group with the self-control of the control group. I measured self-control with a self-control questionnaire (Study 2). I then assessed performance on an Implicit Association Test (Study 3), physical endurance on a handgrip squeezer (Study 4), success at solving difficult word puzzles—so-called *anagrams* (Study 5), and performance on a working memory task (Studies 6 and 7). Studies 4 to 7 relied on the rationale of the dual-task paradigm (see Hagger et al., 2010, for a review), which is a common method of assessing the initial depletion of self-control by running a subsequent task that requires self-control. Study 6 additionally investigated whether fear-induced self-control depletion could be explained by demotivation, and Study 7 investigated the buffering effect of trait self-control against fear-induced self-control depletion.

Study 1: Pilot

This pilot study (Study 1) was conducted as a necessary first step for identifying a reliable method that could be used to induce a moderate amount of fear. I compared three fear-inducing methods. Supported by the empirical findings of Study 1, I decided to use the "speech task" condition—as the most advantageous and effective fear-inducing method—in the subsequent Studies 2 to 7.

Experimental Manipulation of State Fear

The expectations of the method that I would ultimately choose to induce fear were driven by the theoretical assumptions about state fear discussed previously in this work. The demand was threefold: First, the chosen method should induce a moderate amount of fear in the laboratory setting by creating an intrapersonal goal conflict between fear-induced responses and the goal of mastering the task. Second, it should induce only fear and no other mood states. Third, it should be a real-life situation that people are involved in from time to time to ensure that the findings will be applicable outside the laboratory.

Because there is no single standard method for inducing fear, I identified the three most common and promising methods of fear induction by screening studies in which fear was induced in psychological and neurobiological science majors in the past 2 decades. The three fear-inducing methods that fulfilled the demands were the anticipation of giving a public speech (referred to as the "speech task"), the announcement of an intelligence test (referred to as the "intelligence test"), and the expectation of taking an exam (referred to as the "exam"). These three methods were pretested in this study before one of them was selected for use in the subsequent six experiments.

All three methods used *self-threatening* situations to induce fear. These are ideal

stimuli as they induce fear in a way that is largely transposable to several fields of private life and work. For example, in the context of performance in achievement situations, the fear of failure—which is induced by the achievement situation itself—leads to concerns about failure, negative evaluation, or expectations of negative consequences (e.g., Borkovec, 1994). Consequently, it leads to decreased self-efficacy, self-derogatory cognition (Sarason, 1986), and worrisome, task-unrelated, and distracting thoughts (Cadinu et al., 2005; M. W. Eysenck, 1992; Kemeny & Shestyuk, 2008). Self-threatening situations induce the tendency to escape or to shift to lower levels of self-awareness, thus suppressing unwanted thoughts (Baumeister, 1989, 1990; Carver & Scheier, 1981; Heatherton & Baumeister, 1991; Heatherton et al., 1991; Vallacher & Wegner, 1985, 1987). At the same time, such threats represent a challenge, offering one the opportunity to succeed on the actual task (Jerusalem, 1990).

In the first study and in all subsequent studies in the present work, participants were not instructed to regulate their fear responses so that typical real-life fear regulation effects on self-control could be gauged (Egloff, Schmukle, Burns, & Schwerdtfeger, 2006; Pu, Schmeichel, & Demaree, 2010).

Following a short report on the three fear-inducing methods, the control condition, and how these were evaluated, I will report analyses that were conducted to provide support for the decision to use the "speech task" condition in Studies 2 to 7.

"Speech task" condition. The "speech task" condition has been the most frequently used of the three fear-inducing methods presented here (Erdmann & Janke, 2008; McFarlin & Blascovich, 1981; Schlenker, Weigold, & Hallam, 1990). It provokes the anticipation of giving a public speech (Erdmann & Janke, 2008; McNair et al., 1982). The anticipation of having to deliver a public speech is threatening because it entails the possibility of failure or negative judgment by others (Dickerson & Kemeny, 2004). The task substantially increases state fear, heart rate, and blood

pressure (al'Absi et al., 1997; Egloff et al., 2006). Besides the intended emotional and physical stress, the anticipation of giving a public speech can be compounded by the mental load of speech preparation (Zeidner, 1997). The procedure proposed by Erdmann and Janke (2008) takes this important factor into account and suggests that, based on physiological studies, fear-induced unspecific cognitive load can be avoided if participants are not told the topic of their presentation. Thus, during the anticipation period, they are made aware of the threatening task but are not able to engage in preparing the speech itself. I designed my experimental set-up following the procedure proposed by Erdmann and Janke (2008).

The "speech task" was introduced as follows: "This study aims to find out how personality and oral presentation skills are related to each other. For this, we need you to deliver a short speech on a specific topic that we will randomly assign to you in a couple of minutes. As we need to measure your performance, the audience of 35 students and two supervisors will listen to your speech and evaluate it. The audience is already waiting in a room across the hall where students are participating in a training session on verbal and nonverbal communication skills. They have evaluated and compared several speeches and speakers today. They will evaluate the content and the originality of your speech. Furthermore, they will evaluate your verbal and nonverbal skills, such as grammar, dialect, creativity of ideas, intonation, and body language, and rate how much they like your presentation in general. In the end, you will receive feedback from the audience. Try to do your best."

"Intelligence test" condition. The second fear-inducing condition was announced as a test that assesses important aspects of intellectual ability (e.g., an IQ test). The instructions were based on the procedure proposed by Zeidner (1998). It induces fear by emphasizing that success on the test is reflective of one's overall personality as well as academic and occupational success. The instructions participants

received also emphasized that it is important to perform as well as possible because the results will be used to compare the participant with others. The threatening nature of the test was increased by the notion that the participants expected to receive personal feedback from the experimenter. These instructions are self-threatening as they are expected to elicit evaluative concerns and worries (Wine, 1971, 1982).

The instructions were as follows: "The aim of our study is to compare aspects of intelligence of students from different majors. To assess these aspects of your intelligence, we need you to complete an adapted intelligence test. The test consists of different subtasks such as math tasks and creativity tasks. It measures your linguistic abilities, logical-mathematical reasoning, and spatio-visual and interpersonal skills. Afterwards, you will receive personal feedback from the experimenter. By definition, the test reflects your overall personality and is predictive of your future academic performance, occupational success, and your later income. Try to do your best."

"Exam" condition. This technique uses an ego-involving evaluative threat (Auerbach, 1973; Deffenbacher & Hazaleus, 1985), which is an element of the widely used Trier Social Stress Test (Kirschbaum, Pirke, & Hellhammer, 1993). It sets up the assessment environment as an exam (Heinrich & Spielberger, 1982). The unexpected and challenging exam creates an uncertain situation with an overt threat of failure. This kind of uncertainty-inducing situation elicits doubts and concerns about one's own ability to succeed on the task (e.g., Dweck & Leggett, 1988; Nicholls, 1984).

Participants assigned to the third fear-inducing condition "exam" received the following instructions: "The aim of this study is to find out how successfully students can answer real exam questions without preparation. This investigation will help us to determine the effect of preparing for an exam. Your professor and one tutor will ask you several exam questions based on the lecture 'Introduction to Psychology' you

attended recently. They are waiting for you in a room across the hall where they are examining other students at the moment. They will evaluate your answers in the same way they do for a regular exam. After the exam, you will receive feedback on your performance. Try to do your best."

Because of the cover story in this condition, I had to ensure that only participants who attended the lecture participated in this study (all participants assigned to this study attended the lecture 2 to 3 weeks before the experiment).

Control condition. In addition to the three experimental fear-inducing conditions, I included a nonthreatening control condition in the research design. In addition to comparing the three fear inducing conditions, I was able to measure the total effect of induced fear and to establish a sufficient and reliable framework for further experiments by including the control condition.

Participants assigned to the control condition received the following instructions: "This study aims to find out how personality and oral presentation skills are related to each other. Therefore, as one part of the experiment, you will anonymously evaluate a student's presentation that will be given in a couple of minutes."

The hypothesis in this study was that any of the fear-inducing conditions would induce more state fear than the control condition. I ensured that trait anxiety did not differ across the experimental groups as differences in trait anxiety could create differences in state fear. Furthermore, because the assessment of trait anxiety itself could increase state fear (Bertrams et al., 2010; Watson, Clark, & Tellegen, 1988), I assessed trait anxiety with an online pretest prior to conducting the main experiment.

Method

Participants. One hundred forty undergraduate students (68 women, 72 men) participated in this study in exchange for credit that would count toward fulfilling a

course requirement. Participants were on average 25 years old ($M = 24.8, SD = 0.34$, age range 20–36 years). All of them were students at the Technische Universität München studying management or engineering or were enrolled in teacher training courses.

Procedure.

Pretest procedure. The aim of the pretest was to assess trait anxiety. I invited participants via email to participate in the online assessment. All participants completed the online assessment 8 to 14 days before arriving at the laboratory. For ethical reasons, I did not collect sensitive personal data, but because authentic reports are crucial to this study, participants created a personal code consisting of their day and month of birth and their parents' initials. Thus, the procedure seemed personalized even though it was completely anonymous, as it was not possible to identify the participants' real names from their personal codes. In this study, the personalized procedure was more beneficial than complete anonymity. Given that the students participated to receive course credit, completely anonymous testing would have reduced accuracy and demotivated participants (see Lelkes, Krosnick, Marx, Judd, & Park, 2012, for a review). Participants were told that the online form simply involved completing some questionnaires about themselves.

STAI: trait form. The pretest consisted of the State-Trait Anxiety Inventory trait subscale (STAI; Spielberger, 2010; German version: Laux, Glanzmann, Schaffner, & Spielberger, 1981; $\alpha = .95$ in the present study), unrelated filler questions, and demographic questions. The STAI trait form is a 20-item self-report instrument designed to assess four areas of trait anxiety, namely, worry, tension, apprehension, and nervousness. It measures the enduring symptoms of anxiety on a 4-point Likert scale (1 = *almost never* to 4 = *almost always*; e.g., "I feel nervous and restless"). A higher mean score across all 20 items indicates higher trait anxiety.

Filler items. To ensure that participants would not assume that the investigation was about fear regulation, the STAI trait subscale was followed by 40 unrelated questions on general interests and future plans that have often been used in previous research (Sedikides, 1994).

Demographics. Last, participants answered demographic questions on age, education, and gender. Afterwards, they signed up for the laboratory experiment. In Study 1 and all subsequent studies reported here, participants were assured that their answers would remain completely confidential.

Main test procedure. Two days before the main experiment, all participants ($N = 140$) received a reminder email to come to the laboratory. On arrival, participants were brought into the laboratory by an assistant experimenter, seated in separate experimental cubicles, and provided with standardized instructions about how to work with the PC. After giving the instructions, the assistant experimenter left the participants alone during the experiment. The procedure was administered using the experimental software Inquisit (Version 2.0.60616). Participants were asked to insert their personal code and were then randomly assigned to one of three fear-inducing conditions or to the control condition.

Experimental manipulation. The particular task instructions ("speech task," "intelligence test," "exam," or control condition) were presented on the screen and remained an additional 2 min with a note informing participants that the assistant experimenter needed a couple of minutes to prepare the setting for the announced task and that they should wait for further instructions and double-check that they had understood the task. Thus, participants had time to become aware of the threatening nature of the task in the fear-inducing conditions or the neutral nature of the task in the control condition. After reading the instructions and waiting for 2 min, participants completed the STAI state form, the mood control items (PANAS), and

the manipulation check items.

STAI: state form. The STAI state subscale (STAI; Spielberger, 2010; German version: Laux et al., 1981; $\alpha = .93$ in the present study) is a 20-item self-report subscale that assesses—different from the trait subscale—the transient state that is experienced as fear. Participants indicated the state fear they were experiencing at that moment on a 4-point Likert scale (1 = *not at all* to 4 = *very*; e.g., "I feel tense"). A higher mean score across the 20 items indicates higher state fear.

PANAS. A mood measure was administered to show that the manipulation did not affect mood except for inducing fear. Participants thus completed the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988; German version: Egloff, Schmukle, Burns, Kohlmann, & Hock, 2003; 20 items; $\alpha = .91$ in the present study). The positive mood dimensions of the PANAS are joviality, self-assurance, and attentiveness; negative mood dimensions are hostility, guilt, sadness, and fear. Participants indicated on a 5-point Likert scale (1 = *not at all* to 5 = *extremely*) their mood states, rating adjectives such as "enthusiastic" or "scared." Only scores for the two fear-related items ("scared" and "afraid") in the fear-inducing conditions were expected to differ from those in the control condition.

Manipulation check items. Last, participants answered two manipulation check items to test whether the fear manipulation was convincing and whether participants were motivated to master the announced task. They rated the item "How vividly can you imagine yourself performing the announced task?" on a 4-point Likert scale (1 = *not at all* to 4 = *very much so*) and the item "How much effort will you invest to do well on the announced task?" on a 4-point Likert scale (1 = *none* to 4 = *a lot*).

Participants were thanked and fully debriefed by the experimenter. On account of the threatening nature of the study, the experimenter was careful to explain the importance and need for this research and to assuage any fears or concerns partici-

pants may have had. The experimenter was careful to ensure that no participant left the laboratory feeling distressed.

Results and Discussion

Participants in all four conditions reported the same level of trait anxiety, $F(3, 136) = 0.01$; $p = .999$, $\eta_p^2 = .00$. The prediction in this study was that the fear inductions would be successful—the fear-inducing conditions were expected to induce more fear than the control condition. First, I tested for relative differences in state fear between all conditions by conducting a one-way ANOVA using the state fear score as the dependent variable. The one-way ANOVA revealed a significant difference between the experimental conditions, $F(3, 136) = 19.50$, $p < .001$, $\eta_p^2 = .30$. The means in the fear-inducing conditions were larger than those in the control condition, indicating that participants experienced more fear in the fear-inducing conditions than in the control condition (means are depicted in Table 1). Planned comparisons—with Bonferroni corrections for the number of comparisons—confirmed a significant difference between the fear-inducing conditions (see Table 1 for mean differences). The difference between the "speech task" condition and the control condition ($\Delta M = 0.81$) was significant, $t(136) = 6.47$, $p = .001$, $\eta_p^2 = .24$; the difference between the "intelligence test" condition and the control condition was significant ($\Delta M = 0.43$), $t(136) = 3.41$, $p = .005$, $\eta_p^2 = .08$, and also the difference between the "exam" and the control condition ($\Delta M = 0.81$) was significant, $t(136) = 6.74$, $p = .001$, $\eta_p^2 = .24$. The contrast between the "speech task" and the control condition, and also between the "exam" and the control condition revealed, according to J. Cohen (1992), a large effect size of $\eta_p^2 = .24$, and the contrast between the "intelligence test" and the control condition revealed a medium effect size of $\eta_p^2 = .08$. Thus, I decided to use either the "speech task" condition or the "exam" condition. To fur-

Table 1
Post Hoc Planned Multiple Comparisons of "Speech Task" Condition, "Intelligence Test" Condition, "Exam" Condition, and Control Condition with Bonferroni Correction

							95% CI	
Condition (I)	*N*	*M*	*SD*	Condition (II)	*ΔM* (I-II)	*p*	*LB*	*UB*
"Speech task"	35	2.72	0.48	"Intelligence test"	0.38*	0.016	0.05	0.72
				"Exam"	0	0.999	-0.33	0.33
				Control	0.81††	0.001	0.47	1.14
"Intelligence test"	35	2.34	0.59	"Speech task"	-0.38*	0.016	-0.72	-0.05
				"Exam"	-0.38*	0.016	-0.72	-0.05
				Control	0.43††	0.005	0.09	0.76
"Exam"	35	2.72	0.45	"Speech task"	0	00001	-0.33	0.33
				"Intelligence test"	0.38*	0.016	0.05	0.72
				Control	0.81††	0.001	0.47	1.14
Control	35	1.91	0.56	"Speech task"	-0.81††	0.001	-1.14	-0.47
				"Intelligence test"	-0.43††	0.005	-0.76	-0.09
				"Exam"	-0.81††	0.001	-1.14	-0.47

Note. Dependent Variable = state fear score; ΔM = mean difference; *CI* = confidence interval; *LB* = lower bound; *UB* = upper bound.
*$p < .05$, two-tailed. ††$p < .01$, one-tailed.

ther analyze whether the "speech task" and the "exam" conditions induced different degrees of fear, I tested the two conditions against each other by running additional post hoc contrasts. An ANOVA analysis—with Bonferroni correction for the number of comparisons—revealed that the contrast test did not indicate a significant difference between the "speech task" condition and the "exam" condition ($\Delta M = 0.00$), $p = .999$, $\eta_p^2 = .00$. To decide on the best method, I took the manipulation check items "imaginable" and "important" into account and compared the ratings on these two items between the two conditions. I again ran a one-way ANOVA and Bonferroni-adjusted contrasts (Tabachnick & Fidell, 2007). The analysis revealed a significant difference between the fear-inducing conditions on the manipulation item "imaginable." Participants rated the "speech task" condition as more imaginable ($M = 3.91$; $SD = 0.28$) than the "exam" condition ($M = 2.86$, $SD = 0.62$) and the contrast effect

was significant, $F(1, 136) = 128.19$, $p < .001$, $\eta_p^2 = .49$. The ratings on the second manipulation check item "importance" did not differ between the "speech task" condition ($M = 4.40$, $SD = 0.55$) and the "exam" condition ($M = 4.54$, $SD = 0.62$) and revealed a very small and nonsignificant contrast effect, $F(1, 136) = 1.01$, $p = .317$, $\eta_p^2 = .01$. As a result of the manipulation check, the "speech task" condition was found to be more imaginable and was thus preferable.

Last, it was important to ensure that the hitherto preferred fear-inducing method, the "speech task" condition, would not lead to any mood changes—either positive or negative—besides inducing fear and the changes that were also induced by a neutral condition. Therefore, I conducted a one-way ANOVA for the two subscales of the PANAS comparing the "speech task" condition with the control condition. The Bonferroni-corrected post hoc analysis revealed that there was no significant difference regarding the positive mood scale between the "speech task" condition ($M = 2.95$, $SD = 0.70$) and the control condition ($M = 2.98$, $SD = 0.76$). The effect was small and nonsignificant, $F(1, 136) = 0.29$, $p = 0.866$, $\eta_p^2 = .00$. The two fear-related items on the negative mood scale were expected to differ between the fear-inducing and the control conditions. The analysis revealed a significant contrast effect between the "speech task" condition ($M = 2.37$, $SD = 0.51$) and the control condition ($M = 1.58$, $SD = 0.46$); $F(3, 136) = 28.45$, $p < 0.001$, $\eta_p^2 = .17$. The two fear-related items had the lowest correlations with the other items on the negative mood scale and led the scale to have a lower reliability ($\alpha = .87$; after the fear-related items were excluded from the negative mood subscale: $\alpha = .92$). There was no significant difference in negative mood between the "speech task" and control conditions after the two fear-related items were excluded. The contrast effect for the "speech task" ($M = 1.63$, $SD = 0.36$) versus the control condition ($M = 1.73$, $SD = 0.37$); $F(1, 136) = 0.54$, $p = 0.463$, $\eta_p^2 = .00$ was nonsignificant. Based on the reported results, the "speech

task" condition was selected as the most advantageous and effective method of inducing fear in the given laboratory setting and was used in the subsequent studies reported below. In all subsequent studies, I applied exactly the same "speech task" condition procedure.

Study 2: Self-Report

To investigate the main hypothesis of the present research, namely, that regulating fear depletes self-control *(Hypothesis 1)*, I conducted Studies 2 to 7. In all of these studies, I applied a control group design and an experimental manipulation of state fear. To do this, I used the "speech task" to induce a moderate amount of fear in the fear condition and a neutral task in the control condition. Both conditions were introduced and evaluated in Study 1 above. After the manipulation, I measured self-control with different instruments.

Introduction to the State Self-Control Capacity Scale

In the second study, I measured self-control after the manipulation with the German version of the 10-item State Self-Control Capacity Scale (SSCCS) because it has good face validity and is easy to administer (Howard, 1994). The SSCCS was originally introduced by Ciarocco, Twenge, Muraven, and Tice (2010) and was translated into German by Bertrams, Unger, and Dickhäuser (2011). The authors demonstrated that the German version of the SSCCS provides a valid assessment of changes in self-control. The internal consistency of the 10-item scale was satisfactory (Cronbach's $\alpha = .86$ across the validation studies). Example items include "I have lots of energy," "My mental energy is running low" (reverse scored), and "I feel mentally exhausted" (reverse scored). Participants indicate on a scale ranging from 1 = *not true* to 7 = *very true* how they feel at that moment. The mean score is computed by recoding the reversed items. Higher scores indicate higher self-control. In accordance with *Hypothesis 1*, participants in the fear-inducing condition were expected to achieve lower scores than those in the control condition.

Method

Participants. One hundred twenty-six undergraduates (64 men and 62 women) at the Technische Universität München participated in the present study in return for course credit. Participants' average age was 24.02 years ($SD = 2.66$) and ranged between 20 and 36 years. The participants were enrolled in the introductory psychology course but were majoring in different subjects, such as teacher training (58%), management (34%), and engineering (8%). To ensure that participants would not gain explicit knowledge about the true purpose of the study, the experiment took place before their course in introductory psychology had begun.

Procedure. Upon arriving at the laboratory, students provided informed consent and were seated in separate experimental cubicles. The experiment was conducted on personal computers using the experimental software Inquisit (Version 2.0.60616). The study was presented as an experiment on "personality and performance."

First, all participants answered demographic questions—equivalent to those in Study 1—and completed an unrelated filler task that appeared to assess personality traits and bolstered the cover story. Participants answered questions about their interests and habits for approximately 10 min.

Next, participants were randomly assigned to either the fear-inducing or the neutral control condition. The fear-inducing condition was exactly the same as the "speech task" from Study 1; the control condition was the same as in Study 1 as well. After reading the instructions, participants were given an additional 2 min to become aware of either the threatening or neutral nature of their task before they were informed that the announced task had to be skipped because the study had reached its capacity.

To assess self-control, all participants completed the German version of the SSCCS (Cronbach's $\alpha = .89$ in the present study).

Last, participants were thanked, fully debriefed, and told why the deception was necessary. During the debriefing, all participants confirmed that they had not surmised the true purpose of the investigation. Because of the threatening nature of the task, the experimenter was careful to ensure that no participant left the study feeling distressed.

Results and Discussion

Prior to collecting the data, I determined the necessary sample size. According to J. Cohen (1992), 57 participants in each condition were required to detect the meta-analytically reported medium effect size of general self-control depletion ($d = 0.62$; Hagger et al., 2010; error probability of $\alpha = .05$ and power of .95). Exploratory analyses indicated that neither age nor gender had a significant impact on the outcomes reported below.

Consistent with the prediction, the participants in the fear-inducing condition ($M = 4.03$, $SD = 0.75$) scored lower on the SSCCS than those in the control condition ($M = 4.33$, $SD = 0.94$). An independent t test (one-sided), which compared the average self-control scores of the participants in the fear-inducing condition with the scores of the participants in the control condition, revealed that the mean difference between the two conditions was significant, $t(124) = -1.97$, $p = .03$, $d = 0.36$.

This result supported *Hypothesis 1*, which predicted that fear regulation would deplete self-control. Nevertheless, the depletion effect size of $d = 0.36$ (small effect size; J. Cohen, 1992) that was observed in this study was lower than the average effect of $d = 0.62$, which had a 95% confidence interval that ranged from medium to large effect, CI [0.57, 0.67], observed within 83 studies on self-control depletion and

reported by Hagger and colleagues (2010).

One possible explanation for the small size of the self-control depletion effect might be that fear regulation consumes less of the self-control resource than other self-control-demanding tasks that were examined in the meta-analysis above. Another reason could be that the fear induction was too weak and a more threatening stimulus would lead to a larger depletion effect. On the other hand—as shown in Study 1—the "speech task" is able to induce a moderate amount of fear. A much stronger fear induction would lack practical relevance as it would be unusual in the work environment and in everyday life. A third reason for the smaller effect size could be the psychometric properties of the self-report questionnaires. Self-reports depend on the participants' awareness of the assessed states (Nisbett & Wilson, 1977). It is likely that participants are unable to accurately indicate the true amount of their momentary self-control. Self-report instruments also rely on participants' willingness to report honestly and are easy to manipulate, especially if an instrument's face validity is high (Bornstein, Rossner, Hill, & Stepanian, 1994). In view of the fact that self-control is a very desirable aspect of the self (Baumeister, Campbell, Krueger, & Vohs, 2003), the chances are high that participants' reports tend to be overly optimistic as people generally wish to create positive impressions (e.g., Crowne & Marlowe, 1960). The resulting social desirability bias may diminish the construct validity of the self-report measures and mask the true effect. Thus, the fear-induced self-control-depletion effect might decrease on account of this response tendency (e.g., Gordon, 1987).

To overcome these limitations (i.e., lack of awareness and social desirability bias), I assessed self-control with an indirect instrument in Study 3.

Study 3: State Self-Control IAT

Study 2 provided the first evidence that fear regulation leads to self-control depletion. Study 3 was designed to replicate the findings of Study 2 and to enhance measurement power by overcoming the limitations of the self-report instrument. Therefore, to test the hypothesis that fear regulation depletes self-control *(Hypothesis 1)*, I applied the same state fear manipulation procedure as in Study 2, but replaced the self-report instrument with an indirect assessment technique in the form of an adapted version of the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998). To set the stage for Study 3, I will outline the theoretical rationale of the IAT, followed by a short review of its properties and advantages. Next, I will briefly describe how I adapted the IAT (in the following, I refer to the adapted IAT as the State Self-Control IAT). Then I will briefly review the validation studies on the State Self-Control IAT (Melny & Kehr, 2013) before reporting the procedure and the results of Study 3.

Introduction to the Implicit Association Test

Operationally defined, an IAT measures the relative strengths of associations between targets and attributes (Greenwald, Smith, Sriram, Bar-Anan, & Nosek, 2009). For example, Greenwald and his colleagues (1998) adapted one of the first IATs to measure the association strength between the names of flowers or insects (targets) and pleasant or unpleasant words (attributes). Participants showed a stronger association between "flowers" and "pleasant" words than between "insects" and "pleasant" words. To determine the strength of this association, Greenwald et al. asked the participants to perform a series of item categorization tasks under time pressure. The series comprised three practice and two critical blocks. In the practice blocks, participants became acquainted with the response keys and learned how to categorize

the items. In the first critical block, participants categorized target and attribute items by pressing one response key for "insects" and "pleasant" words and the other response key for "flowers" and "unpleasant" words. Later, participants completed a second critical block in which the pairings were switched. Participants pressed one key for "flowers" and "pleasant" words and the other response key for "insects" and "unpleasant" words. The relative strength of associations was then calculated by comparing the participants' response speed in the first critical block to the response speed in the second critical block. Participants performed the categorization tasks more quickly when the strongly associated targets and attributes ("flowers" and "pleasant") shared the same response key, and they performed the categorization tasks more slowly when the weakly associated targets and attributes ("insects" and "pleasant") shared the same response key.

According to Slabbinck, De Houwer, and Van Kenhove (2011), an IAT is a general procedure rather than a specific test and can be adapted to various domains. IATs have mostly been adapted to assess stable attitudes (Greenwald, Smith, et al., 2009; Hugenberg & Bodenhausen, 2004) but have also been used to measure changes in states—for example, after experimentally inducing aggression or to assess situationally activated stereotypes (Blair, Ma, & Lenton, 2001; Gawronski & Bodenhausen, 2006; Greenwald & Farnham, 2000; Karpinski & Hilton, 2001; Lowery, Hardin, & Sinclair, 2001; Richeson & Ambady, 2003). Even though it would be reasonable to apply the IAT to assess state changes, there is no adapted version of the IAT available for assessing state self-control.

One important reason for using an IAT instead of a self-report instrument is that IATs are less biased by conscious distortion than self-report instruments. Evidence that the IAT is a more suitable instrument than a self-report is provided by the meta-analysis by Greenwald, Poehlman, Uhlmann, and Banaji (2009). In several

studies, IATs showed better predictive validity for behavior than self-report measures, especially if sensitive constructs were assessed, such as alcoholism, aggression, stereotypes, or prejudice. Conscious manipulation or faking threatens the validity of self-report instruments (Egloff & Schmukle, 2002; Holden, Wood, & Tomashewski, 2001; Viswesvaran & Ones, 1999). Several studies have shown that even IATs are not immune to faking, but they are more resistant to it than self-report measures. For example, studies have shown that it is easy for participants to fake shyness (Asendorpf, Banse, & Mücke, 2002) and race attitudes (Kim, 2003) on the self-report instruments, but not on corresponding IATs. Only participants who were explicitly instructed beforehand about how to fake the IAT (e.g., to slow down their reactions on one of the IAT blocks) were able to manipulate the results (De Houwer, Beckers, & Moors, 2007). Nevertheless, naive participants did not discover such faking strategies on their own (Cvencek, Greenwald, Brown, Gray, & Snowden, 2010).

Another reason for why an IAT is a more suitable instrument for assessing state self-control than a self-report instrument is based on the fact that self-report instruments rely on the assumption that people have unlimited access to their thoughts, feelings, and abilities (Nisbett & Wilson, 1977). This assumption has been challenged by several dual-process system theories (e.g., Epstein, 1994; Fazio & Towles-Schwen, 1999; A. Freud, 1936/1958; Hofmann et al., 2009; Metcalfe & Mischel, 1999; Strack & Deutsch, 2004; T. D. Wilson, Lindsey, & Schooler, 2000). Dual-process theories posit two modes of information processing and behavior regulation: the conscious mode and the automatic mode. Individuals are not able to report on processing that occurs in the automatic mode (e.g., Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005). Based on these assumptions, several studies have shown that indirect methods—because they can access both the conscious and automatic modes—have incremental validity above and beyond those provided by self-report instruments (Egloff

& Schmukle, 2002; Friese, Hofmann, & Wänke, 2008; McConnell & Leibold, 2001; Perugini, 2005; Schnabel, Banse, & Asendorpf, 2006). As self-control processes are assumed to operate in both modes (Friese et al., 2008), an indirect assessment technique should be better able to access the automatic mode of the self-control than a self-report instrument.

Adaptation of the State Self-Control Implicit Association Test

The adapted State Self-Control IAT relies on the same rationale as the IATs that were introduced by Greenwald et al. (1998). It measures how much more quickly participants can categorize "me"-related target items (words describing themselves) and "self-control"-related attribute items when they share the same response key than when the items describing themselves and "depletion"-related items share the same response key.

The items ($N = 12$) I used for the contrasted target categories "me" and "others" were exactly the same as those used in several IATs that assess self-related associations (e.g., Kiefer & Sekaquaptewa, 2007; Nosek, Banaji, & Greenwald, 2002). The attribute items ($N = 12$) were extracted from the most recent questionnaires on self-control and were selected by seven experts. The questionnaires used were the State Self-Control Capacity Scale (SSCCS-D; Bertrams et al., 2011) and the Selfregulatory Skills Questionnaire (FSSTK; Schmidt & Imhoff, 2010). The items that were extracted by experts were then pretested on a sample of 108 participants in order to ensure that participants could categorize the items exclusively either as "self-control"-related items or as "depletion"-related items. Only items that fulfilled this requirement were employed in the State Self-Control IAT. The overview of the State Self-Control IAT task sequence and sample items are presented in Table 2.

Table 2
Illustration of the State Self-Control IAT Procedure

Block	Number of trials	Task description	Category (left key)	Category (right key)	Sample items
1	20	Target discrimination practice	"me"	"others"	my, self, theirs, you
2	20	Attribute discrimination practice	"depletion"	"self-control"	exhaustion, fatigue, concentration, attention
3	20+60	Combined discrimination practice and test	"me" and "depletion"	"others" and "self-control"	my, theirs, exhaustion, concentration
4	60	Reversed attribute discrimination practice	"self-control"	"depletion"	concentration, attention, exhaustion, fatigue
5	20+60	Reversed combined discrimination practice and test	"me" and "self-control"	"others" and "depletion"	my, theirs, concentration, exhaustion

Note. The State Self-Control IAT consists of five discrimination blocks in a fixed order (numbered rows). The number of trials for each block is shown in the second column (e.g., Block 3 comprises 20 practice trials and 60 test trials). Blocks and their function are explained in the third column. Blocks 1, 2, and 4 are discrimination practice blocks. Blocks 3 and 5 are critical blocks used for data gathering. Categories for each task assigned to the left key are depicted in column 4 and those assigned to the right response key are depicted in column 5. Sample items are shown in column 6. The fourth and fifth columns depict items that were used as category labels. Due to the translation of the items, their length is less homogenous than in the initial German version (see Table A1 in the Appendix, for the complete item set).

Structure of the State Self-Control Implicit Association Test

After brief instructions about how to respond to the IAT items (e.g., which response keys should be pressed), participants completed a sequence of categorization tasks comprising five blocks. Figures 1 to 5 display the computer screens for each block. The State Self-Control IAT was presented to participants as a task that requires them to respond as rapidly as possible—by categorizing each presented item—while also remaining as accurate as possible—by avoiding errors.

Block 1. The State Self-Control IAT begins with a practice block. The aim of the practice block is to teach participants how to categorize target items correctly. Over the course of 20 trials, participants practiced distinguishing between two con-

trasted target categories: "me" and "others." On each trial, an item appeared in the center of the screen (see Figure 1). Category labels were displayed in the left and right corners. In the first block, participants were instructed to press the response key on the left every time a "me"-related item appeared on the screen and the response key on the right when an item from the "others" category appeared.

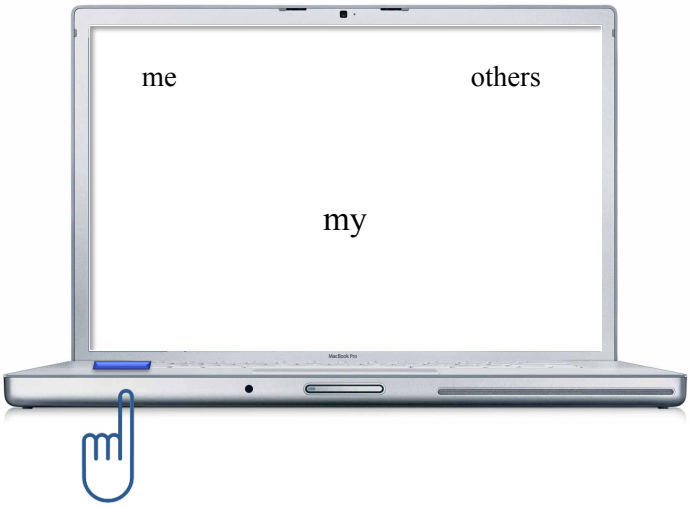

Figure 1. Block 1: Target discrimination practice. Category labels are displayed in the corners. The item is presented in the center. The "hand" symbolically points to the left key that participants were instructed to press for a correct response. In the actual experiment, the response keys were highlighted with a blue sticker.

Block 2. In the following block, participants classified attribute items into two contrasting categories: "depletion" and "self-control." They practiced the discrimination task by pressing the left response key when a "depletion" category item appeared and the right response key when a "self-control" category item appeared (see Figure 2).

Block 3. The third block is the first of the two critical blocks used for data collection to compute the IAT score. Critical blocks combine the target and attribute discrimination tasks. In the third block, the target category "me" was combined with the attribute category "depletion," sharing the left response key, and the target

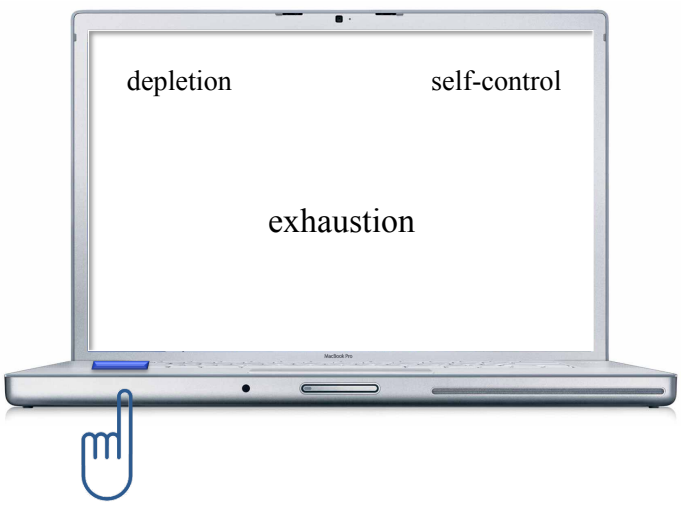

Figure 2. Block 2: Attribute discrimination practice.

category "others" was combined with the attribute category "self-control," sharing the right key (see Figure 3). The theoretical rationale behind this critical block is that if participants' self-control has been temporarily depleted, putting "me"- and "depletion"-related items into the same category by using the same key will be relatively easy because those categories will be strongly associated in that given moment. On the other hand, participants whose self-control has not been depleted ought to perform more slowly on this block compared with participants whose self-control has been temporarily depleted.

Block 4. The next block is an attribute discrimination practice block with reversed key assignments in which attribute categories are switched from their Block 2 settings. Participants pressed the left response key for items related to the category "self-control" and the right response key for items related to the category "depletion" (see Figure 4).

Block 5. This final block is the second critical block. The procedure is similar to that of Block 3. It combines target categories as used in Block 3 and the previously reversed attribute assignment as practiced in Block 4. For this block, participants

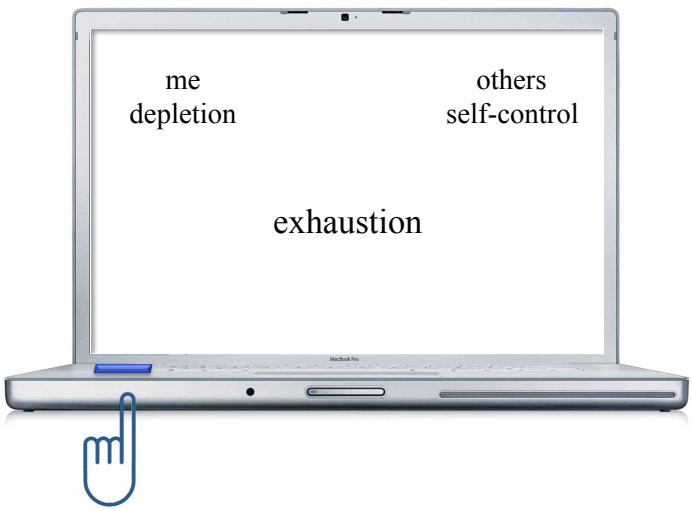

Figure 3. Block 3: Combined discrimination task.

were instructed to press the left response key for items related to the categories "me" or "self-control" and the right response key for items related to "others" or "depletion" (see Figure 5).

The theoretical rationale behind this critical block is different from that of Block 3. If participants' self-control has been temporarily depleted, their response speed when "me"- and "self-control"-related items share a key should be relatively slow because those categories should not be associated in that given moment. On the other hand, participants whose self-control has not been depleted should perform this block more quickly than participants whose self-control has been temporarily depleted.

In the validation studies, the State Self-Control IAT score was calculated by applying the modified scoring algorithm introduced by Greenwald, Nosek, and Banaji (2003). The IAT score is computed based on response speeds from both critical blocks (Block 3 and Block 5). According to the logic of the IAT (Greenwald et al., 1998), association strength determines response speed. If participants' self-control is temporarily depleted, they should show stronger associations between "me" and "depletion" than between "me" and "self-control." Participants whose self-control

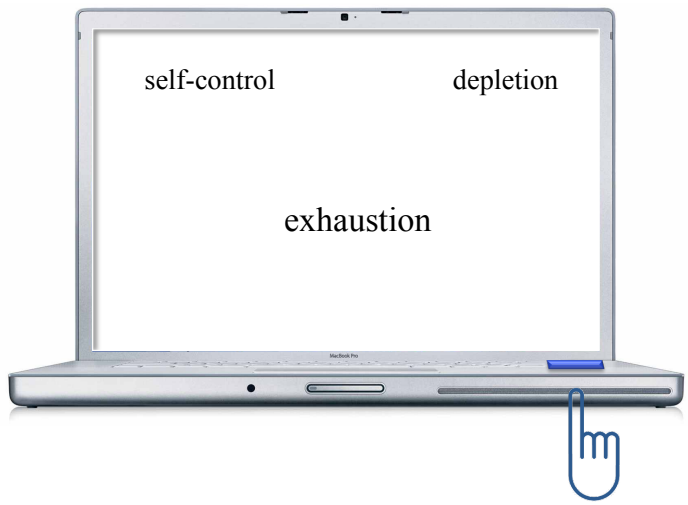

Figure 4. Block 4: Reversed attribute discrimination practice.

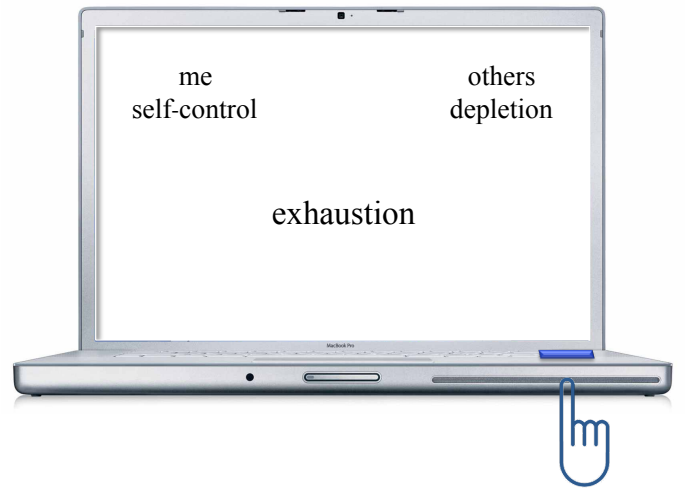

Figure 5. Block 5: Reversed combined discrimination task.

is not depleted would be expected to show stronger associations between "me" and "self-control" than between "me" and "depletion." Put in highly simplified terms, the IAT score—which represents the association strength—is calculated as the difference in the average response speeds that participants showed on each combined block. More precisely, the score is calculated by subtracting the average response speed from Block 5 from the average response speed from Block 3. A negative IAT score reflects low self-control and a positive IAT score reflects high self-control. For

example, if participants' self-control is temporarily depleted, they should be faster on Block 3 (categorizing "me"- and "depletion"-related items using the same key) than on the reversed Block 5 (categorizing "me"- and "self-control"-related items using the same key). Subtracting the average reaction time on Block 5 from the one on Block 3 would result in a negative IAT score. If participants' self-control is not depleted, they should be slower on Block 3 than on Block 5. Subtracting the average response time on Block 5 from the one on Block 3 would then result in a positive IAT score. In keeping with the scoring algorithm, I deleted all overly fast responses ($< 400\ ms$) and replaced the categorization errors by the average block reaction speed plus 600 ms.

The validity of the State Self-Control IAT was previously examined in six studies (Melny & Kehr, 2013). We conducted three laboratory studies and three field studies. We experimentally manipulated state self-control (control group design) and administered the State Self-Control IAT afterwards. IAT score means of the experimentally depleted group were compared with those of the control condition. To manipulate state self-control, we used the modified Stroop task (Stroop, 1935). The modified Stroop task has been successfully applied as a self-control-depleting task in several studies (e.g., Bray, Martin Ginis, Hicks, & Woodgate, 2008; Bruyneel et al., 2009; Gailliot & Baumeister, 2007). The modified Stroop task is a color-word interference task. Participants are instructed to indicate the font color of the presented word (red, green, or yellow) while ignoring the meaning of the word that is a color name. As the meaning of the word never matches the font color, participants must constantly inhibit the tendency to read the word and to respond to its meaning rather to the font color. To prevent participants from strategically ignoring the words' meanings, they have to respond to the meaning of the word if it is presented in a blue font. Thus, in 25% of the trials, participants have to respond to the meaning of the word instead of the font color. In the control condition, participants completed an easy

nondepleting version of the Stroop task, the so-called *congruent* Stroop, in which the color of the font always matches the meaning of the word (e.g., Hagger et al., 2010).

We computed the State Self-Control IAT scores as outlined above for each study. The estimated internal consistency was satisfactory across the validation studies (Cronbach's $\alpha > .81$; average meta-analytic internal consistency for IATs ranged between .70 and .90; Hofmann, 2005; Nosek, Greenwald, & Banaji, 2006).

In the laboratory setting, the Stroop task and the State Self-Control IAT were administered on PCs using the experimental software Inquisit (Version 2.0.60616). In order to test the State Self-Control IAT on a broader sample, we additionally conducted three field studies. These studies were administered using the experimental software Feedbox (Version 2.01), which was developed for this purpose. This software is suitable for millisecond measures in online assessments and runs on all common hardware and operating systems such as Windows and MAC OS outside of the laboratory.

For each study, we conducted a t test with the State Self-Control IAT score as the dependent variable and a state self-control manipulation (depleting Stroop vs. easy Stroop) as the grouping variable. The results were almost identical across the six validation studies. In each study, the State Self-Control score was lower in the depleting condition than in the control condition. This difference between the independent means of the two conditions was significant across all studies. The obtained effect sizes of the differences were medium to large according to J. Cohen (1992). More precisely, the observed effect sizes were $d = 0.73$ in Validation Study 1, ($N = 94$, $\alpha = .86$), $d = 0.71$ in Validation Study 2 ($N = 89$, $\alpha = .86$), $d = 0.58$ in Validation Study 3 ($N = 68$, $\alpha = .87$), $d = 0.69$ in Validation Study 4 ($N = 278$, $\alpha = .85$), $d = 0.59$ in Validation Study 5 ($N = 124$, $\alpha = .82$), and $d = 0.71$ in Validation Study 6 ($N = 89$, $\alpha = .86$). Thus, the State Self-Control IAT was sensitive enough to

detect situational changes in self-control. Thus, the results provided support for the assumption that the State Self-Control IAT is a valid measure of state self-control.

Method

I conducted Study 3 using a control group design. The experimental fear manipulation mirrored the procedure applied in Study 2. The only difference was that the dependent variable state self-control was now measured with the State Self-Control IAT instead of the self-report. Relying on findings from the meta-analysis on ego-depletion by Hagger et al. (2010), I expected a medium-sized depletion effect (J. Cohen, 1992) of fear on state self-control. Given an error probability of $\alpha = .05$ and $power = .95$, 136 participants would be needed to detect the reported average effect of $d = 0.57$.

Participants. Data were collected from 137 undergraduates (58 men and 79 women) enrolled in teacher training programs. They participated in return for course credit. Participants' average age was 25.83 years ($SD = 1.23$) ranging from 22 to 29. To eliminate the possibility of faking, only participants who had no knowledge about the IAT rationale and had not participated in one of the validation studies were assigned to the study.

Procedure. Upon arriving at the laboratory, participants were greeted by the assistant experimenter, signed an informed consent form, and were seated in separate experimental cubicles. The experiment was conducted on PCs using the experimental software Inquisit (Version 2.0.60616). Participants were told that this study aimed to examine how judgment accuracy is related to performance on other practical tasks. Thus, participants expected to perform a series of category judgments on a PC and to perform some practical tasks.

First, they answered the same demographic questions as in Studies 1 and 2. Next,

participants were randomly allocated to either the fear-inducing instructions or the neutral instructions. The fear manipulation was the same as the procedure applied in Study 2.

Next, all participants completed the State Self-Control IAT.

Last, participants were thanked, received a debriefing on the true purpose of the study, and were told why the deception was necessary. During the debriefing, all participants ensured that they had not surmised the true purpose of the investigation. Because of the threatening nature of the task, the experimenter was careful to ensure that no participant left the study feeling distressed.

Results and Discussion

Exploratory analyses showed that neither the gender nor the age of the participants had a significant impact on the results reported below. I calculated the State Self-Control IAT score—in the same way as was done in the validation studies that applied the improved scoring algorithm (Greenwald et al., 2003)—by computing the average reaction times in milliseconds for the two critical blocks and correcting for reaction time errors. I then subtracted the corrected average reaction times of Block 5 from those of Block 3. Internal consistency was calculated according to the procedure described by Schmukle and Egloff (2006) for estimating Cronbach's α for the halves of the IAT on which the attribute and target trials were equivalently represented; it was $\alpha = .86$. Alpha reflects the consistency with which "depletion"-related items were associated with "me"-related items and "self-control"-related items were associated with "me"-related items (Bosson, Swann, & Pennebaker, 2000).

Figure 6 shows the state self-control scores for both experimental conditions. Participants in the fear-inducing condition showed lower State Self-Control IAT scores (M = -0.05, SD = 0.20) than participants in the control condition (M = 0.04,

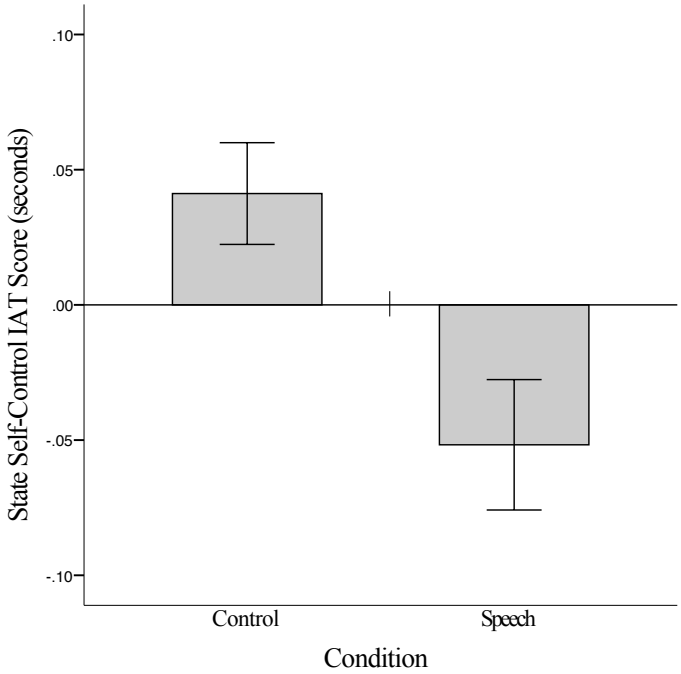

Figure 6. State Self-Control IAT scores of experimental conditions (Control = control condition, $N = 68$; Speech = "speech task" condition, $N = 69$). According to the logic of the IAT scoring algorithms, an IAT score > 0 indicates stronger association between "me" and "self-control" and a score < 0 indicates a stronger association between "me" and "depletion." Error bars represent standard errors of the means.

$SD = 0.16$). An independent t test (one-sided) that used the State Self-Control IAT score as the dependent variable and the experimental condition as the grouping variable revealed that the means of the two conditions differed significantly from each other, $t(135) = -3.03$, $p = .003$, showing a medium effect size of $d = 0.52$ (J. Cohen, 1992). The results provided evidence that converged with the findings from Study 2. Thus, the results from Study 3 also supported the main research hypothesis *(Hypothesis 1)* that regulating fear requires self-control and consequently depletes its capacity. The significantly lower State Self-Control IAT score in the "speech task" condition indicates that fear regulation led to lower state self-control compared with the control condition. The depletion effect measured with the adapted IAT provided a significant medium-sized effect (J. Cohen, 1992) that was larger than the one found

in Study 2. As outlined previously, the smaller effect detected in Study 2 might be explained by limitations of the self-report measures.

Study 4: Handgrip Task

Introduction to the Handgrip Task

Finding the self-control depletion effect across multiple domains of self-control can be considered strong evidence for the hypothesized depletion effect (see Hagger et al., 2010, for a review). Therefore, in Study 4 and the two subsequent studies, I examined effects of fear on different domains of self-control. In the present study, I investigated the physical domain using the handgrip-squeezing task. The rationale for the handgrip-squeezing task (in the following referred to as the "handgrip task") draws on the conceptual model that defines self-control as the physical and mental energy that individuals need to accomplish various regulation tasks (Baumeister et al., 1998). In the late 1930s to early 1940s, the handgrip task was used to predict performance on other self-control tasks (Rethlingshafer, 1942; Thornton, 1939). Moreover, it has been frequently applied in prior studies on self-control depletion, mostly in the dual-task procedure (Alberts, Martijn, Greb, Merckelbach, & Vries, 2007; Baumeister et al., 1998; Baumeister & Vohs, 2007; Bray et al., 2008; Ciarocco, Sommer, & Baumeister, 2001; Hagger et al., 2010; Muraven & Shmueli, 2006; Tyler & Burns, 2008; Vohs et al., 2005). The dual-task procedure assesses initial self-control depletion by running a subsequent unrelated task that requires self-control (Muraven et al., 1998). The handgrip task was used as the subsequent task in this study. Low performance on the subsequent task indicates that self-control has been previously depleted (Baumeister, Vohs, & Tice, 2007). To conduct a handgrip task that all participants would be able to perform regardless of their hand strength, I used a commercially available handgrip exerciser (see Figure 7) that all participants were familiar with.

The handgrip exerciser consists of two handles, which participants can squeeze and

hold with their palm. The spring that holds the handles generates constant pressure. Hence, squeezing the handles together is tiring and quickly becomes uncomfortable or even a little painful. Thus, participants must constantly override the urge to release the handles (Ciarocco et al., 2001). According to the rationale of the dual-task paradigm, if fear regulation consumes self-control, subsequent attempts at self-control should be impaired, and thus, performance on the handgrip task should be lower for participants who experienced fear compared with participants in the control condition. The expected result would converge with the findings from Studies 2 and 3.

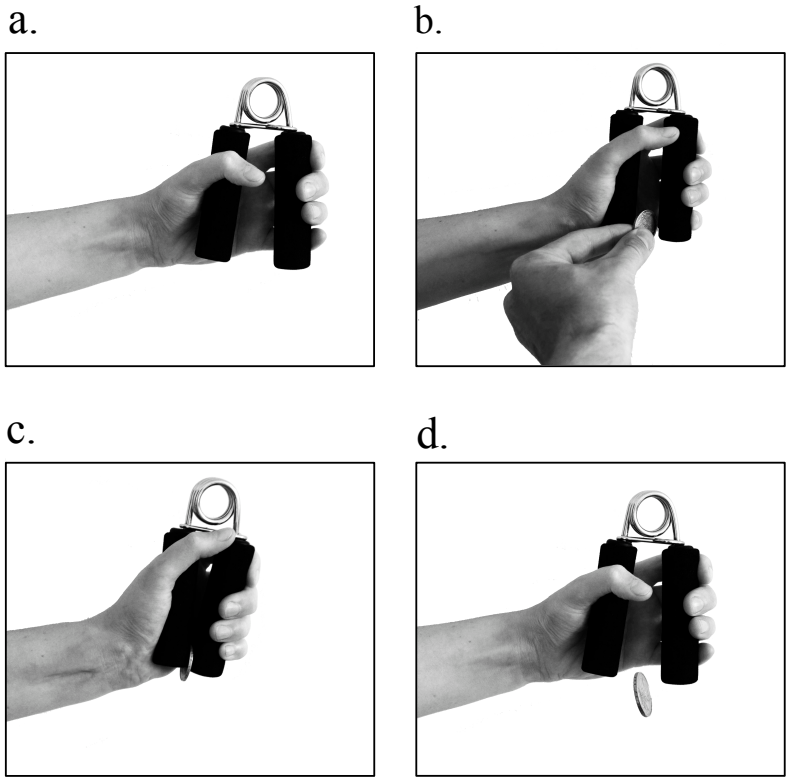

Figure 7. Key elements of the handgrip task procedure. A participant holds the handgrip exerciser in his or her dominant hand (a). The assistant experimenter inserts a two-euro coin between the handles of the handgrip exerciser (b). The participant squeezes the handles together, holding the coin between the handles (c). When the participant releases his or her grip, the coin falls out (d).

Method

Due to the fact that performance on the handgrip exerciser does not depend exclusively on self-control but also on one's general physical strength (Muraven & Shmueli, 2006), in the present study, I applied the pretest-posttest control group design. Thus, participants' performance was assessed twice: before the state fear manipulation (baseline measure) and after the state fear manipulation (postmanipulation measure) to control for individual physical strength (Inzlicht et al., 2006; Martijn et al., 2007; Muraven & Shmueli, 2006; Vohs et al., 2005).

Participants. One hundred twenty undergraduates (54 men, 66 women) studying engineering participated in a laboratory study that was described as an investigation on personality and physical strength. Participants were between the ages of 23 and 29 ($M = 25.95$, $SD = 1.19$). As in all studies in the research reported here, neither psychology majors nor students who had previously participated in one of the fear regulation studies were admitted to this study. Participants were individually tested in 38-min to 46-min sessions and received course credit for their participation.

Procedure. To ensure that participants did not overly tax their physical strength, all participants arrived at the laboratory between 8 a.m. and 10 a.m., without having exercised beforehand. The assistant experimenter who conducted the assessment was blind to the research hypothesis. To minimize the likelihood that the participants would assume the handgrip performance and the fear-inducing task were associated, the assistant experimenter explained that the handgrip task—actually a measure of self-control—was a test of physical strength and that for a most accurate estimate of physical strength, two separate assessments would be necessary (Finkel et al., 2006; Vohs et al., 2005).

The experiment began with the baseline handgrip assessment. The assistant ex-

perimenter inserted a two-euro coin between the two handles of the handgrip exerciser and told the participant to squeeze the handles together with his or her dominant hand and to hold them in that position for as long as possible. When the participant pressed the handles together tightly, the coin remained in between the handles. As soon as the participant loosened his or her grip, the coin fell out (adapted from Muraven et al., 1998). Self-control was operationalized as the time in seconds the participant was able to hold the two handles of the handgrip exerciser together before the coin fell out and was measured with a stopwatch.

Next, all participants answered demographic questions on the computer and completed an unrelated filler task that purportedly assessed personality traits (mirroring the procedure from Study 2) to bolster the cover story and to give them time to recover from the handgrip task.

Next, they were randomly allocated the state fear manipulation instructions, either the fear-inducing "speech task" instructions or the neutral instructions. I used exactly the same fear manipulation procedure as in Studies 2 and 3.

Following this, the assistant experimenter assessed participants' handgrip performance, again giving the same instructions that were given for the baseline handgrip assessment.

Last, participants were thanked and brought into a separate room where an assistant who was not blind to the research hypothesis delivered a debriefing that addressed the purpose of the study and explained why the deception was necessary. During the debriefing, all participants confirmed that they had not surmised the true purpose of the investigation. Because of the threatening nature of the task, the experimenter was careful to ensure that no participant left the study feeling distressed.

Results and Discussion

Exploratory analyses indicated that neither gender nor age had a significant impact on the results reported below. The dependent variable of interest was the post-manipulation performance on the handgrip task. In order to control for individual differences at baseline, I computed a change-score analysis and additionally an analysis of covariance in which I used the baseline measure of the handgrip task performance as a covariate. I computed the change scores by subtracting participants' performance on the second handgrip task from their performance on the baseline handgrip task.

The performance of participants who were assigned to the fear-inducing condition declined more (average decline in performance from the baseline measure to the second measure was 3.70 s, $SD = 5.0$) than the performance of participants in the control condition (average decline in performance from the baseline measure to the second measure was 0.94 s, $SD = 1.0$), $t(118) = -4.25$, $p < .001$, one-tailed, $d = 0.77$ (a medium to large effect size according to J. Cohen, 1992). Table 3 displays the descriptive statistics.

Table 3
Means and Standard Deviations of Participants' Performance on the Two Handgrip Measurements

Condition	Baseline measure		Second measure		
	M	*SD*	*M*	*SD*	*N*
Fear-inducing condition	86.36	29.94	82.66	29.52	60
Control condition	84.38	25.42	83.46	25.60	60

Note. The numbers under the baseline and the second measure columns represent average handgrip squeezing times in seconds.

In addition to the change-score analysis, I computed a one-way analysis of covariance (ANCOVA). Even though change scores are the most commonly assessed depen-

dent variable in research on self-control, I also employed an ANCOVA to overcome the disadvantages of the change-score analysis (Burckhardt, Goodwin, & Prescott, 1982; Cronbach & Furby, 1970). The ANCOVA proved to be the more powerful technique with greater versatility for the given design (Huck & McLean, 1975). For the analysis, the fear manipulation (fear-inducing and control conditions) served as the independent variable. The dependent variable was the postmanipulation handgrip measure. Students' performance on the baseline handgrip task served as the covariate. A test of the homogeneity of regression slopes indicated that the assumption of homogeneity was not violated and the relation between the covariate and the dependent variable did not differ across the experimental conditions, $F(1, 116) = 2.31$, $p = .13$. The ANCOVA on the postmanipulation handgrip performance with the baseline handgrip performance as a covariate revealed a significant effect of the fear manipulation, $F(1, 117) = 12.80$, $p = 0.001$, $\eta_p^2 = .10$ (a medium effect size according to J. Cohen, 1973, 1992; J. Cohen, Cohen, West, & Aiken, 2003). The results of the ANCOVA indicated that after controlling for participants' individual strength, self-control dropped significantly more in the fear-inducing condition than in the control condition. Participants who received neutral instructions were able to hold the handgrip exerciser handles together for a longer period of time than participants in the fear-inducing condition.

These findings are in line with those of Studies 2 and 3 and provide evidence that fear leads to decreased performance on subsequent unrelated physical tasks indicating a medium-sized effect of fear induction on self-control depletion.

Study 5: Anagram Task

This study attempted to replicate and to extend the findings of Studies 2 to 4. To provide further multimethod evidence for fear-induced self-control depletion, in this study, I measured self-control depletion in terms of performance on an anagram task.

Introduction to the Anagram Task

The anagram task is a cognitive processing task presented as a set of letters that participants have to rearrange to build a word. For example, "aertw" is a letter rearrangement of the word "water." The anagram task has been used frequently as an indicator of self-control depletion in the dual-task paradigm (e.g., Baumeister et al., 2006; Gailliot et al., 2006; Gordijn et al., 2004). The anagram task relies on self-control because rearranging letters requires persistence and deep concentration. Participants are required to combine letters in one way, and then, if the combination does not result in an actual word, they have to override their first hunch and try another way. As there is no algorithm for solving an anagram, the task is frustrating and difficult but still achievable (e.g., Baumeister et al., 2006). As in previous studies, I predicted that fear would deplete self-control, and the depletion effect would be indicated by impaired anagram-solving performance (*Hypothesis 1*). The anagram task is an appropriate dependent measure as it is not obviously related to the "speech task," nor does it rely on emotion regulation in the same way as fear does.

Method

As performance on the anagram task depends not only on self-control but also on individual verbal skills, the dependent variable was operationalized as a score computed from the baseline measure and the second (postmanipulation) measure using the pretest-posttest control group design.

Participants. One hundred twenty-five (38 men and 87 women) teacher training students participated in the study in return for partial fulfillment of a course requirement. Two of the participants were non-native German speakers, and three had already participated in Study 1. They were therefore reassigned to another study, where they could earn course credit as well. Thus, data from 120 participants (34 men and 86 women) were collected and analyzed. Participants' average age was 25.63 years ($SD = 2.39$) and ranged from 19 to 32.

Procedure. Participants arrived at the laboratory and signed the informed consent form. The experiment was conducted in groups of two to three individuals in partitioned cubicles. The experimenter introduced the study as an experiment on how people use letters to form words and how they use words to form sentences depending on their personality. The data collection was administered on personal computers using the experimental software Inquisit (Version 2.0.60616).

Before the baseline measurement began, participants were presented with two examples of anagrams along with instructions on how to solve them. In view of the nature and the purpose of the study, the anagram task consisted solely of neutral five-letter words (i.e., no fear and no self-control-related words were included). Participants had 5 min to solve as many anagrams as they could. The anagrams were presented in the same order to all participants. This first measure served as a baseline of individual ability to solve anagrams.

Next, participants answered demographic questions and completed an unrelated filler questionnaire that purportedly assessed personality traits (mirroring the procedures of Studies 2 and 4). This filler task bolstered the cover story and gave participants the opportunity to recover from the effort of the baseline anagram task. The filler task took approximately 10 min.

Then, participants randomly received either the fear-inducing "speech task" an-

nouncement or the neutral task announcement. The fear manipulation exactly mirrored the procedure for the "speech task" introduced in Study 1 and was applied as in Studies 2 to 4. For the second anagram task, which followed the fear manipulation, all participants were given a list of 80 different anagrams. Participants again had 5 min to complete as many as they could.

Last, participants received a careful debriefing with a probe for suspicion and were thanked. As in previous studies, the experimenter was careful to ensure that no participant left the study feeling distressed.

Results and Discussion

Exploratory analyses indicated that participants' gender and age had no impact on the results reported below. I used change scores in performance on the anagram tasks as the dependent variable to control for individual differences in anagram-solving ability.

For each participant, I calculated the change score by subtracting his or her number of anagrams solved on the baseline task from the number of anagrams solved on the second anagram task. The performance of the participants who were assigned to the fear-inducing condition declined (the average decrease from the baseline measure to the second measure was 2.90 words, $SD = 7.11$); by contrast, the performance of the participants in the control condition improved (the average increase from the baseline measure to the second measure was 1.08 words, $SD = 1.0$), $t(118) = -4.32$, $p < .001$, one-tailed, $d = 0.78$ (a medium to large effect size according to J. Cohen, 1992). These results provided further support for the assumption that fear regulation depletes self-control (*Hypothesis 1*). Table 4 displays the descriptive statistics.

An additional analysis of covariance (ANCOVA) yielded the same results as the analysis that used change scores. Preliminarily, a test of the homogeneity of regression

Table 4
Means and Standard Deviations of Participants' Performance on the Two Anagram Tasks

Condition	Baseline measure		Second measure		
	M	*SD*	*M*	*SD*	*N*
Control condition	23.80	4.16	24.88	4.27	60
Fear-inducing condition	24.18	5.21	21.28	3.83	60

Note. The means of the baseline and second measures represent the average numbers of anagrams solved.

slopes was conducted and indicated that the assumption of homogeneity of regression slopes was tenable. The ANCOVA that used the number of anagrams solved before the fear manipulation as a covariate revealed converging evidence that the participants who were assigned to the fear-inducing condition solved fewer anagrams on the second anagram task ($M = 21.28$, $SD = 3.81$) than the control subjects ($M = 24.18$, $SD = 5.20$), $F(1, 117) = 18.67$, $p < .001$, $\eta_p^2 = .14$, $R^2 = .27$, $f = 0.39$ (a medium to large effect size according to J. Cohen, 1992). Thus, the findings of this study are consistent with the results of Studies 2, 3, and 4 and provide further support for the generality of fear-induced self-control depletion.

Study 6: Working Memory Capacity Task

The aim of Study 6 was to provide further evidence for the generality of fear-induced self-control depletion. In this study, I measured self-control depletion using the working memory capacity task (WMC; Oberauer, 2009). The main hypothesis that fear regulation leads to self-control depletion *(Hypothesis 1)* would be supported in this study by finding that participants' performance on the WMC task declined after the fear induction.

Demotivation

An additional goal of this study was to rule out one alternative explanation that proposed that decreases in performance on self-control tasks are the result of demotivation following unpleasant situations rather than the result of self-control depletion (Boksem, Meijman, & Lorist, 2006; Hagger et al., 2010; Job, Dweck, & Walton, 2010; Lorist, Boksem, & Ridderinkhof, 2005; Muraven & Slessareva, 2003; Wan & Sternthal, 2008).

Thus, an additional prediction was that fear would not lead to performance decrements on tasks that demand motivation and effort but that do not require self-control *(Hypothesis 2)*. The two tasks (i.e., the self-control task and the so-called "nonregulatory" task, which does not require self-control) were designed to differ only in how much self-control they required, but they were equally effortful, unpleasant, and difficult.

The compensatory model (Kehr, 2000, 2004c) and the strength model of self-control (Muraven et al., 1998) provided a theoretical approach to the distinction between tasks that rely on self-control and nonregulatory tasks. The compensatory model states that a problem-solving task can be resolved by applying well-learned techniques, but this process is effortful as it requires the problem-solver to devote

conscious attention toward attaining a solution (Kehr, 2000, 2004c). For example, difficult, complex, and challenging tasks such as solving math problems do not require self-control (Bargh & Chartrand, 1999). In common with other well-learned acts, math problem-solving is automated to some extent (Bargh & Chartrand, 1999; Fitzsimons & Bargh, 2004; Muraven & Baumeister, 2000; Norman & Shallice, 1986) and can be completed by applying algorithms and heuristics rather than by overriding impulses or thoughts or by suppressing automatic responses (Bargh & Williams, 2007; Baumeister, Vohs, & Tice, 2007; Muraven & Slessareva, 2003).

Nonregulatory tasks are frequently used in the dual-task paradigm as neutral tasks in the control condition to parallelize the procedure of self-control manipulation. In such experiments, the experimental group completes a self-control-depleting task and the control group completes an effortful but nondepleting task (e.g., DeWall et al., 2007; Friese et al., 2008; Johns et al., 2008; Vohs & Schmeichel, 2003; Wallace & Baumeister, 2002; Wright, Stewart, & Barnett, 2008).

Frequently used nonregulatory tasks are math problem-solving tasks of moderate difficulty (e.g., DeShon, Brown, & Greenis, 1996; Muraven et al., 1998). In several studies, participants confirmed that solving math problems was as frustrating and effortful as tasks that relied on self-control (Muraven, Collins, & Neinhaus, 2002; Muraven et al., 1998).

In the present study, the nonregulatory task was operationalized by adapting a math problem-solving procedure previously used by Muraven et al. (1998). In this task, participants solved difficult addition problems without any aids. They added two 2-digit numbers, for example, "15 + 53." Participants had up to 5 sec to solve each equation. They were advised to solve the equations as quickly and as accurately as possible. In total, the task lasted for 5 min. Participants were given a larger number of equations than they would be able to solve within 5 min.

Introduction to the Working Memory Capacity Task

As a self-control-demanding task, I used the WMC task by adapting the procedure introduced by Oberauer (2009). Working memory is essential for remaining self-controlled (Carver & Scheier, 1998; Conway et al., 2005; Schmeichel, 2007). It is required to override automatic impulses, inhibit automatic responses, and hold goal-relevant information in mind while processing competing information or other distractions. WMC task performance fluctuates over time. It has been shown to depend on prior engagement in affective and cognitive self-control acts (e.g., Barrett, Tugade, & Engle, 2004; Conway, Kane, & Engle, 2003; Hinson et al., 2003; Hofmann, Gschwendner, Friese, Wiers, & Schmitt, 2008; Kane et al., 2004; Klein & Boals, 2001; Schmader & Johns, 2003; Schmeichel, Volokhov, & Demaree, 2008) and is considered a reliable measure of self-control (e.g., Park, Glaser, & Knowles, 2008; Schmeichel et al., 2008; Wright et al., 2007). The WMC task is operationalized as the processing capacity available for memorizing information while simultaneously performing a distractor task (Barrett et al., 2004). During the WMC task, participants solve simple mathematical equations (simple addition or subtraction tasks) and indicate whether the given solution is correct or incorrect. For example, participants are presented with the equation "6 + 2 = 9," and they have to indicate whether the presented solution is correct or incorrect. In the example "6 + 2 = 9," the presented solution is incorrect (the correct solution is 8). Besides solving the equations, participants are asked to memorize the presented 1-digit solution for later recall (9 in the given example) and to suppress the correct solution (8 in the given example), which differs from the presented one in approximately 50% of the cases. Each equation is presented for 3 sec. After solving one equation and memorizing the solution participants advance to the next equation, solve it, and memorize the next

presented solution. Participants are guided through two practice sets before completing 15 test sets. The set lengths on the test range from four to eight equations. The sets of equations were presented in ascending order: $4, 4, 4, 4, 5, 5, 5, 6, 6, 6, 7, 7, 7, 8, 8$. For example, one of the four-equation sets was:

Does $6 + 2 = 9$? (correct answer: "No")

Does $4 + 2 = 6$? (correct answer: "Yes")

Does $7 - 5 = 2$? (correct answer: "Yes")

Does $6 + 1 = 3$? (correct answer: "No")

After each set of equations, participants try to recall the solutions in the order in which they were presented. Depending on the length of the string, they had up to 10 sec to enter the result.

For example, the recall for the four-equation set presented above would be presented as follows:

recall: _ _ _ _ (correct answer: 9 6 2 3)

Participants work through 86 equations that are presented in the same order for each participant.

Method

Participants. Sixty-four undergraduates (38 women, 26 men) participated in this study, which was announced as a study investigating motivation and personality, in exchange for course credit. All were on average 23.30 years old ($SD = 2.23$, age range: 20–32 years). Participants were students at the Technische Universität München enrolled in teacher training (27%), economics (67%), and other majors (6%). As in all the studies reported in this research, psychology majors were not admitted to the study. I also did not admit participants who had participated in previous experiments on fear regulation or who had previously performed the math problem-

solving task or the WMC task because the possibility of testing effects could not be ruled out (e.g., Schmeichel, 2007).

Procedure. Participants arrived at the laboratory and after signing informed consent forms, they were seated in separate cubicles and introduced to the experimental software Inquisit (Version 2.0.60616).

First, participants provided the same demographic information as in previous studies and were randomly assigned to one of the experimental conditions ("speech task" condition or control condition). The experimental fear manipulation followed. All participants received the same instructions that were successfully pretested in the pilot study and applied in Studies 2 to 5.

Participants then completed the nonregulatory math problem-solving task and performed the WMC task.

Last, participants were fully debriefed. During the debriefing, all participants confirmed that they had not surmised the true purpose of the investigation. The experimenter was careful to ensure that no participant felt distressed when leaving the laboratory.

Results and Discussion

Exploratory analyses revealed that neither gender nor age had an impact on the results reported below. The math task performance score was operationalized as the number of equations solved correctly. As predicted, participants' performance on the math problem-solving task did not differ between the fear-inducing condition (M = 15.67, SD = 3.80) and the control condition (M = 15.78, SD = 4.55). An independent t test (one-sided) confirmed that the mean difference between the two conditions was not significant, $t(62)$ = -0.17, $p > .50$ (exact p = 0.86), d = 0.02, *power* = .95. The test did not find differences in the motivation to perform an

effortful task between the two experimental conditions.

To compare participants' performance on the self-control task, the WMC score was computed by using the validated algorithm introduced by Conway et al. (2005). Put in simplified terms, this algorithm combines the two components of the task to determine the WMC score: the accuracy of the solutions and the ratio of the correctly recalled solutions in the correct order (Kane et al., 2004). The Spearman-Brown-adjusted split-half reliability for the score was computed on two subtests of an equal number of sets that matched in length. The reliability in this study ($r = .83$) was high. As predicted, WMC scores differed significantly between the fear-inducing condition ($M = 0.26$, $SD = 0.15$) and the control condition ($M = 0.34$; $SD = 0.08$), $t(62) = -2.81$, $p = 0.007$, $d = 0.66$ (a medium effect size according to J. Cohen, 1992).

This result offers further support for the fear-induced self-control-depletion hypothesis *(Hypothesis 1)*. Participants in the "speech task" condition performed worse on the WMC task than did the control participants. More importantly, fear regulation impaired participants' performance on the self-control task but not their performance on the nonregulatory math problem-solving task, which requires motivation. These findings disconfirm the alternative explanation that performance decrements on self-control tasks are the result of demotivation *(Hypothesis 2)*.

In sum, the findings in all five studies suggest that the hypothesized fear-induced self-control-depletion effect appears to be quite robust and generalizable across different domains and cannot be explained by demotivation.

Study 7: Trait Self-Control

In Study 7, I examined the buffering effect of trait self-control against fear-induced self-control depletion. Based on the theoretical assumptions reported below, the main prediction of this study was that fear-induced self-control depletion would be moderated by individual differences in trait self-control so that high trait self-control would facilitate fear-regulation and buffer the depleting effect of fear on state self-control *(Hypothesis 3)*.

Although mounting evidence suggests that all individuals are vulnerable to self-control depletion, theories of limited self-control also postulate a protective role of trait self-control (e.g., Dvorak & Simons, 2009; Funder, Block, & Block, 1983; Hagger et al., 2010; Metcalfe & Mischel, 1999; Muraven & Baumeister, 2000; Schouwenburg, 2004; Wills & Dishion, 2004). For example, the strength model of self-control postulates that high trait self-control protects people against the depletion of their state self-control (Baumeister et al., 2006; Muraven et al., 1998; Tangney et al., 2004). Kehr (2000, 2004c) as well as Kuhl and Fuhrmann (1998) also state that people high in trait self-control might employ volitional strategies more effectively to overcome self-control depletion.

Introduction to Trait Self-Control

Trait self-control is usually defined as the general ability to exert self-control (Baumeister & Heatherton, 1996; Baumeister, Vohs, & Tice, 2007; Hofmann, Rauch, & Gawronski, 2007; Tangney et al., 2004). There are various metaphors that describe trait self-control. Researchers refer to it as a resource pool (Hui et al., 2009; Muraven, Baumeister, & Tice, 1999), a reservoir of fuel (Schmeichel, 2007), a muscle (Baumeister et al., 2006), a skill (Carver & Scheier, 1998), or the ability to apply volitional strategies (Baumeister et al., 2006; Kuhl & Fuhrmann, 1998).

Volitional strategies are essential for accomplishing self-control-demanding tasks—for example, to support goals that conflict with behavioral tendencies (e.g., Emmons, 2003; Kehr, 2000, 2004c; Kuhl, 1999; Ryan et al., 1996). As outlined previously, according to Kehr (2000, 2004b) and Kehr and von Rosenstiel (2006), key volitional strategies are attention control (Atkinson & Birch, 1970; Baumeister & Heatherton, 1996; Egeth & Yantis, 1997; James, 1890/1981; Mischel, 1996; Norman & Shallice, 1986; Wegner & Schneider, 1989), emotion control (Bagozzi & Pieters, 1998; Damasio, 2005; Forgas et al., 1998; Gross, 1999; Horowitz, 1988; Josephson, 1996; LeDoux, 1995; Totterdell & Parkinson, 1999), motivation control (Lewin, 1927; Martin & Tesser, 1989; Mischel, 1996; Oettingen et al., 2001), and decision control (Jostmann & Koole, 2007; Koole & van Knippenberg, 2007; Kuhl, 1999).

Beginning in the 1960s, Mischel and colleagues (Mischel, 1974, 1996; Mischel, Shoda, & Peake, 1988) provided conclusive support for the predictive role of trait self-control on later regulation success in their pioneering work on delay of gratification in 4- and 5-year-old children. In their experiments, children were asked to resist the temptation to immediately eat desired sweets in order to receive more sweets a few minutes later. The ability to resist the temptation of immediate gratification at the age of 4 or 5 predicted later self-control abilities, cognitive competences, academic success, and adult Body Mass Index (Mischel & Ayduk, 2004; Schlam et al., 2013; Shoda, Mischel, & Peake, 1990). This line of research has consistently demonstrated that trait self-control is a general predictor of success in various spheres of life (Mischel & Ayduk, 2004; Schlam et al., 2013) and protects individuals from self-control failures.

More recent research has provided further evidence that trait self-control determines self-regulation success. Correlational survey studies have shown that trait self-control is positively related to a host of desirable outcomes such as psychological

well-being, success in coping with stress, physical health, and mental health. Trait self-control has also predicted adherence to laws and social norms, academic achievement, maintenance of sustainable personal relationships, and relationship satisfaction (Brandon et al., 2003; S. Cohen & Williamson, 1991; Gordijn et al., 2004; Hammer, 2005; Heatherton, 1993; Kieras, Tobin, Graziano, & Rothbart, 2005; Levy, 2006; Tangney et al., 2004).

Moreover, trait self-control has been shown to be negatively related to alcoholism, substance abuse, gambling, depression, phobic anxiety, hostile anger, aggressive behavior, eating disorders, and procrastination (Baumeister et al., 1994; DeWall et al., 2007; Steel, 2007; Tangney et al., 2004; Tice & Bratslavsky, 2000; Vohs & Heatherton, 2000). People low in trait self-control were more prone to chronic diseases such as cancer, heart disease, and venereal disease, and were less able to manage their finances than people high in trait self-control (e.g., Heatherton, 1993; Muraven et al., 1999; Schmeichel et al., 2003; Vohs & Faber, 2007).

In experimental studies, Schmeichel and Zell (2007) showed that participants high in trait self-control were able to tolerate a painful stimulus for a longer time period than participants low in trait self-control. They also performed better on the eye-blink inhibition test (Jackson, Malmstadt, Larson, & Davidson, 2000) than participants low in trait self-control. Trait self-control also predicted persistence on a challenging mirror tracing task that required motor skills (Brandon et al., 2003) as well as breath-holding endurance (Brown, Lejuez, Kahler, Strong, & Zvolensky, 2005; Hajek, Belcher, & Stapleton, 1987). Participants high in trait self-control were better at ignoring death-related thoughts and were less depleted by those death-related thoughts than participants low in trait self-control (Gailliot et al., 2006).

Further support for the buffering effect of trait self-control has been provided by Baumeister and his colleagues using the analogy to a muscle that becomes stronger

and is improved through regular exercise (Baumeister et al., 2006). In one of the initial studies investigating this notion, Muraven et al. (1999) instructed participants to practice simple everyday tasks that require self-control, such as paying attention to their posture, controlling their moods, monitoring their eating habits, and avoiding slang, for 2 weeks. Participants who did so were less vulnerable to self-control depletion, or, more precisely, participants who had been trained in this manner performed better on the handgrip task after suppressing thoughts of a white bear (Wegner, Schneider, Carter, & White, 1987) than control subjects.

The investigation by Oaten and Cheng (2006b) used physical exercise as a trait self-control-enhancing technique. Participants participated for 2 months in physical exercise programs that included fitness training and weightlifting. Prior to the training, almost all participants showed a strong depletion effect after the "white bear" task (Wegner et al., 1987). Afterwards, participants who had received the physical exercise training were less depleted by the "white bear" task than the control subjects. The depletion of self-control was measured using the visual tracking task (Scholl, Pylyshyn, & Feldman, 2001), which requires constant attention to visual targets while ignoring distractors. The training group participants also reported being more effective at controlling other everyday activities that required self-control and claimed greater emotional stability than the control group (Oaten & Cheng, 2006a, 2006b).

The many studies that have observed the buffering effect of trait self-control notwithstanding, a meta-analysis on self-control by Hagger and colleagues (2010) included some studies that did not find this buffering effect (e.g., Gailliot et al., 2007; Stillman, Tice, Fincham, & Lambert, 2009). Additionally, research by Imhoff, Schmidt, and Gerstenberg (2013) found a negative effect of trait self-control on the performance of self-control tasks. Taken together, Hagger and colleagues (2010) eval-

uate the interplay of trait self-control and self-control depletion as still inconclusive.

To shed light on the interplay between trait self-control and the variables used in this research, in Study 7, I investigated the buffering effect of trait self-control against fear-induced self-control depletion, postulating that high trait self-control insulates participants from fear-induced self-control depletion *(Hypothesis 3)*.

Method

Participants. One-hundred sixty undergraduates (93 women, 67 men) participated in this study, which was introduced as a study on motivation and personality. The mean age of the participants was 25.4 years (SD = 0.29, age range: 20–36 years). During the assessment, participants were students at the Technische Universität München enrolled in teacher training courses and were given course credit for their participation. None of them had participated in a study on fear regulation previously or had performed the working memory test in other contexts.

Procedure. To collect the data, I administered an online pretest and a laboratory experiment. The separation of the laboratory experiment from the pretest was necessary to ensure the trait self-control assessment would not affect the stated self-control measurement. The pretest also facilitated a brief and standardized administration of the laboratory experiment.

Pretest procedure. The pretest assessed trait self-control and the demographic data. Participants took part in the online assessment 5 to 7 days before the laboratory experiment. The procedure of the online assessment was similar to the one used in Study 1.

In order to assess trait self-control, I relied on the four self-control-relevant subscales of the German version of the Volitional Components Inventory (VCI: Kuhl & Fuhrmann, 1998; German Version: Kuhl & Fuhrmann, 1997).

The trait self-control subscales are motivation control, emotion control, attention control, and decision control, each consisting of six items (α = .83 in this study). The VCI measures trait self-control by assessing how often individuals use self-control strategies (Kuhl, 1985, 1999; Kuhl & Goschke, 1994). The rationale behind the VCI is that people who are high in trait self-control use volitional strategies more often than people low in trait self-control (Forgas et al., 1998). VCI has repeatedly been shown to be a reliable and valid measure of trait self-control. The score on this instrument predicted, inter alia, children's resistance to temptations and academic success (e.g., Baumann & Kuhl, 2005; Kuhl & Fuhrmann, 1998; Orbell, 2003).

The 24 trait self-control items were prefaced by the question "How often have you recently experienced the following processes or situations?" Participants responded to each item using a Likert scale ranging from 1 = *very rarely* to 7 = *very often*. An example item on the motivation control subscale was "considering positive incentives concerning this matter" (α = .89 in this study for this subscale). The emotion control scale contained the item "cheering myself up to make things work" (α = .86 in this study for this subscale). An item on the attention control subscale was "trying consciously to keep my attention stable" (α = .89 in this study for this subscale), and one item on the decision control subscale was "having no difficulties with spontaneous decisions" (α = .81 in this study for this subscale). To calculate the trait self-control score, all subscales were combined into a composite measure based on prior evidence that the four subscales all loaded on one common factor (Kehr, Bles, & von Rosenstiel, 1999; Kuhl & Fuhrmann, 1998). Participants' answers on the VCI were coded so that higher scores indicated higher trait self-control.

After completing the VCI, participants provided the same demographic data as in Studies 1 to 6.

Last, as in Study 1, participants generated a personal code, which allowed me to

match the data from the pretest with those from the main test and at the same time to ensure that the data collection procedure remained anonymous.

Main test procedure. Two days before the main experiment, the participants received a reminder email to come to the laboratory. All participants who filled out the online assessment ($N = 160$) participated in the laboratory study. After arriving at the laboratory and signing an informed consent form, the assistant experimenter showed the participants how to work with the experimental software Inquisit (Version 2.0.60616). Participants were tested in groups of two to six in a spacious laboratory room. Everyone worked on her or his own computer.

First, they inserted their personal code and were randomly allocated state fear manipulation instructions. The procedure mirrored the one applied in Studies 2 to 6. After the experimental manipulation, all participants performed the working memory capacity (WMC) task to assess their state self-control. The Spearman-Brown-adjusted split-half reliability of the WMC task measure, calculated from two subsets matched in set length, was high ($r = .83$).

Last, participants were thanked and received a debriefing that explained the true purpose of the study and why the deception was necessary. During the debriefing, all participants confirmed that they had not surmised the true purpose of the investigation. Because of the threatening nature of the task, the experimenter was careful to ensure that no participant left the laboratory feeling distressed.

Results and Discussion

As in the previous studies, fear regulation led to self-control depletion indicated by lower WMC test scores in the "speech task" condition ($M = 0.27$, $SD = 0.12$) compared with the control condition ($M = 0.34$, $SD = 0.12$), $t(158) = \text{-}3.22$, $p = .002$, $d = 0.51$, indicating a medium-sized effect (J. Cohen, 1992) for the one-sided t test.

Participants' gender and age did not affect the results reported in this study.

The additional hypothesis of this study *(Hypothesis 3)* predicted that participants' trait self-control ($M = 5.29$, $SD = 0.42$) would moderate the effects of the fear manipulation on state self-control so that the depletion effect would be buffered by high trait self-control. To inspect the moderating role of trait self-control (measured with the VCI), I computed a hierarchical multiple regression analysis (J. Cohen et al., 2003) in which I regressed the performance on the WMC task ($M = 0.31$, $SD = 0.13$) on the standardized VCI score, fear manipulation (contrast coded for the experimental conditions [-1 = control condition; 1 = fear-inducing condition]), and their centered interaction term (Aiken & West, 1991). For each regression, the assumptions of normality, homogeneity, and error independence were verified through inspection of the residuals and a normal q-q plot. Diagnostics of leverage, discrepancy, and influence were also considered for each regression to confirm that the relations were not the result of a few extreme or influential cases.

The overall model was statistically significant, $F(3, 156) = 8.13$, $p < .001$, $R^2 = .13$. The main effect of fear manipulation was significant, $\beta = -.25$, ($SE = 0.08$), partial $r = -.25$, $t(156) = -3.31$, $p = .001$, indicating that participants in the fear-inducing condition had lower state self-control after the experimental manipulation than the control group participants. The main effect of trait self-control was also significant, $\beta = .19$, ($SE = .08$), partial $r = .19$, $t(156) = 2.55$, $p = .013$, such that the participants low in trait self-control performed worse on the WMC task than the participants high in trait self-control.

However, as expected, both main effects were qualified by their significant interaction. The interaction term increased the amount of explained variance by $R^2 = .04$, $F(1, 159) = 6.14$, $p = .013$, $\beta = .19$, ($SE = .07$), partial $r = .19$, $t(156) = 2.50$, $p = .014$. Thus, the relation between trait self-control and state self-control differed

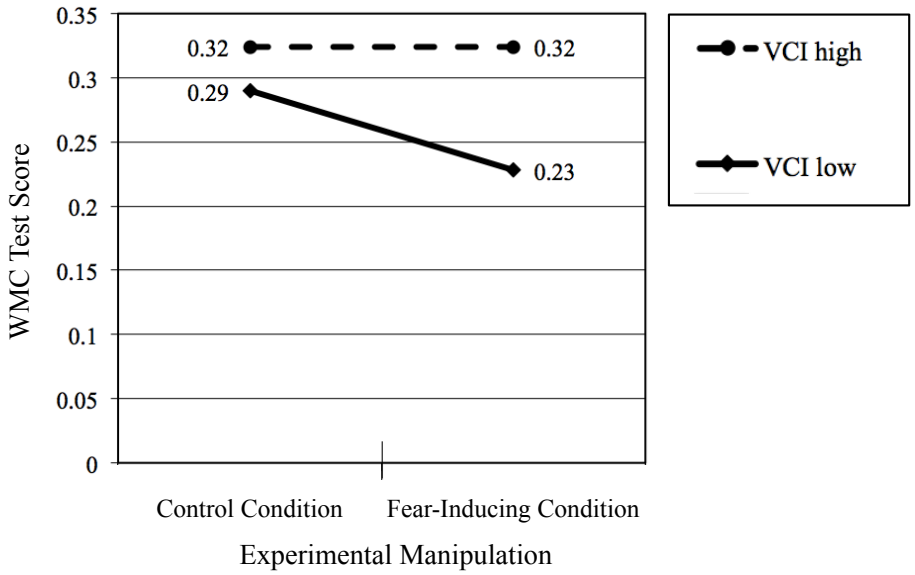

Figure 8. Simple slopes analysis. State self-control operationalized as performance on a WMC test as a function of the experimental manipulation and trait self-control (VCI; high vs. low) in Study 7 (estimated slopes). Higher WMC scores indicate better performance and less self-control depletion.

significantly between the two experimental conditions. The simple slopes analysis was used to probe the significant interaction (Aiken & West, 1991). The simple slope for participants scoring one standard deviation above the mean of trait self-control (+1 *SD*) did not differ significantly from zero, β = -.06 (*SE* = 0.10), partial *r* = -.06, *t*(154) = -0.56, *p* = .585. By contrast, for participants scoring one standard deviation below the mean of trait self-control on the VCI (-1 *SD*), the simple slope of the experimental condition was significant, β = -.43, (*SE* = 0.10), partial *r* = -.43, *t*(154) = -3.94, *p* < .001 (see Figure 8). Taken together, the results of the simple slope analysis indicated that the effect of the fear manipulation on state self-control was significant and robust for participants low in self-control but was nonsignificant and negligible for those high in trait self-control. The depleting effect of fear on state self-control occurred primarily among participants low in trait self-control. High trait self-control seems to buffer the state self-control-depleting effect of fear. Thus, the

buffering hypothesis *(Hypothesis 3)* was shown to be applicable to the domain of fear regulation.

General Discussion

This research extends knowledge of the relation between self-control and fear regulation, which has not been previously investigated despite a large amount of theorizing on the subject. This current research documents the importance of self-control when regulating fear and adds to the understanding of when and why people fail to exert self-control.

The findings in this research correspond to the theoretical considerations that have suggested a connection between self-control and fear regulation (Arndt et al., 1997; Baumeister, Vohs, & Tice, 2007; Bertrams et al., 2010; Gailliot et al., 2006; Kehr, 2004a, 2004c; Wood et al., 2001) and integrate the assumption that self-control is a limited resource (Baumeister et al., 1998) into the intrapersonal conflict-solving fear-regulation process (Kehr, 2000, 2004c; McClelland, 1985; Ryan et al., 1996).

Summary of the Findings

Study 1 identified the "speech task" as the most efficient method for inducing a moderate amount of fear. Studies 2 to 7 showed that self-control plays a key role in the fear-regulation process and that fear regulation depletes self-control, thus affecting individuals' ability to exert self-control at a later time (*Hypothesis 1*). With a variety of dependent measures, I found support for this spillover effect on the subsequent ability to exert self-control across different domains of self-controlled behavior. The spillover effect was indicated by a lower score on a self-control questionnaire (Study 2), poorer performance on the State Self-Control IAT (Study 3), decreased physical endurance on a handgrip squeezer (Study 4), reduced success at solving anagrams (Study 5), and poorer subsequent performance on the working memory capacity task (Studies 6 and 7).

Consequently, the first and most important implication of this research is that

fear regulation and self-control draw on the same general resource, which is needed not only to regulate the thoughts and feelings that people suppress to regulate fear, but also to perform different tasks and behaviors that rely on self-control.

The second implication is that fear regulation consumes the limited resource of self-control, spilling over onto subsequent fear-unrelated self-control tasks, but not onto nonregulatory tasks that rely on motivation *(Hypothesis 2)*. The third implication is that trait self-control buffers the fear-induced depletion effect on state self-control as I was able to show that self-control depletion appears to occur for people low in trait self-control in particular *(Hypothesis 3)*.

Alternative Explanations, Limitations, and Future Research

The most common alternative explanations for the fear-induced self-control-depletion effect that was found (see Hagger et al., 2010, for a review) were ruled out by the experimental design and additional analyses. Specifically, the results appeared independent of the effects of social desirability (Studies 3 to 7), the cognitive load that results from speech preparation (Studies 1 to 7), mood (Study 1), and motivation (Study 6). None of the results can be explained by any features of the study other than the experimental manipulation. The pilot study, the experimental design, and the additional dependent measures also helped to reduce the possibility that the findings could have been the result of methodological artifacts.

As it is possible that extraneous factors may also influence the size of the self-control-depletion effect (Hagger et al., 2010), the laboratory experiments were highly standardized. It is also possible that after a set of exhausting and tedious lectures or while preparing for an exam, self-control may be depleted. This could also have affected the experiment. Thus, to avoid those confounding effects, the participants in each study were tested before the lectures and before the exam preparation period

began.

Despite these efforts, there were still shortcomings and limitations that future research can overcome. Furthermore, it is conceivable that the patterns found in the current studies are somehow limited to the specific domains of self-control or measures used, although very different measures were used across the studies. Thus, the central challenge for future research will be to examine the breadth of the problems to which fear-induced self-control depletion could contribute. Therefore, studies should investigate a broader variety of different dependent variables in the laboratory setting and in the field. For example, effects of fear regulation on dieting, alcohol intake, aggressive parenting, and performance on self-control-demanding tasks at work would be of high practical relevance.

Fear induction method. Another factor that limits the generalizability of these results is that I applied only one standardized method of fear-induction, which induced a moderate amount of fear and resulted in self-control depletion. The conclusion that fear leads to self-control depletion can thus be drawn only for situations that induce at least a moderate amount of fear. The present findings may apply less well to other short-term threats—such as specific threats such as spiders, or more general threats such as terrorism. Different fear-inducing stimuli might lead to somewhat more or less negative affective states or intrusive thoughts that people then suppress, thereby expending self-control. As fear can be activated by a variety of aversive stimuli, as a response to the social behavior of others, by loud noises, or by sudden and uncontrolled events (Derakshan & Eysenck, 2009; Kemeny & Shestyuk, 2008; Lazarus & Folkman, 1984; Lerner & Keltner, 2000; C. A. Smith & Ellsworth, 1985), further evidence is required to generalize the present results to other fear-inducing stimuli.

Sample. An additional potential limitation involves the sample, which consisted of college students. Even though Hirschi and Gottfredson (2000) noted that the variation in self-control in the population of college students provides an adequate representation of self-control in the broader population and thus, the findings are generalizable, further research should nevertheless investigate fear-induced self-control depletion in different samples.

Moderators. Future research should also continue to search for additional moderators that are relevant for fear-induced self-control-depletion processes. One promising avenue for gaining more insight into such processes would be to measure individual differences in the sensitivity to fear induction.

Trait anxiety or the fear motive characterize peoples' sensitivity or proneness to perceiving stimuli as threatening (Atkinson, 1964; Birney et al., 1969; Cattell & Scheier, 1961; S. Freud, 1926/1959; H. Heckhausen, 1975; Higgins, 1998; McClelland, 1985; Rapee, 1991; Spielberger & Barratt, 1972; Twenge, 2000). It is reasonable that individuals high in trait anxiety have stronger fear responses, which they have to regulate; thus, they may therefore be more susceptible to self-control depletion than individuals low in trait anxiety. Furthermore, Kehr (2004c) proposes that the depletion of self-control depends on the strength of the conflict between the activated fear motive and a person's goals. Findings from research on trait anxiety have supported this proposition, showing that people high in trait anxiety compared with less anxious people of the same ability level expend more energy to succeed on a test (Blanchette & Richards, 2003; M. W. Eysenck et al., 2007; Fox, Russo, & Dutton, 2002; Mogg et al., 2000; E. Wilson & MacLeod, 2003; Wood et al., 2001).

Motives. Across the studies reported here, the "speech task" was designed to activate all facets of the fear motive, as the fear motive has been adduced to be

an overall factor in most validation studies on motive scales (see Sokolowski et al., 2000, for a review). Nevertheless, some theorists propose differentiating between the fear components of power, achievement, and affiliation motives (e.g., McClelland, 1995). A recent study by Gröpel and Kehr (2013) showed that motives moderate self-control depletion. How motive-specific fear-eliciting stimuli deplete self-control and the interplay of those stimuli with individuals' fear motive should be investigated in the future.

Improving self-control.

> From the military school of life: What does not kill me makes me stronger. (Nietzsche, 1889, Chapter 3/8)

In the light of the evidence that fear induction depletes self-control, an important question emerges: How can the negative effects of fear induction be counteracted? One conclusion drawn from the present investigation is that trait self-control buffers the depleting effect of fear. Muraven et al. (1999) state that regularly exercising self-control might help to counteract the depletion effect. Whether general self-control training or the specific improvement of particular self-control strategies can help people to attenuate fear-induced self-control depletion should be investigated in detail.

Concluding Remarks

Fear-eliciting situations are part of peoples' lives, and in attempting to regulate fear—as the present research showed—people expend their self-control. Thus, after successfully regulating fear, one's regulation success may begin to fail on subsequent self-control-demanding tasks in daily life and in professional spheres. Besides the investigated domains, fear regulation might undermine success in performing any behavior that requires self-control, such as sticking to one's diet and choosing a healthy

meal instead of eating fast food, resisting the urge to drink or smoke, resisting other temptations, controlling emotions and emotional outbursts, restraining aggression, pushing oneself to keep working on a paper on a beautiful summer afternoon, keeping promises, meeting the next challenge, and the like (Bandura, 1997; Baumeister et al., 1994; Cicchetti, Ackerman, & Izard, 1995; Hagger et al., 2010).

One basic proposal might be that people should avoid fear-related situations, try to eliminate fear-inducing stimuli from their environment, or at least try to postpone further self-control attempts when in a fear-inducing situation. When these actions are not possible, people who have to deal with fear constantly or on a regular basis could benefit from improvements in their trait self-control, which has been shown to help in maintaining self-control even in the face of fear.

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Appendix

Items Used in the German Version of the State Self-Control IAT

Table A1
State Self-Control IAT Items

Category	Items	*(Translation)*
"Self-control"	willensstark*	*(self-control)**
	aufnahmefähig	*(absorbability)*
	kontrolliert	*(self-awareness)*
	aufmerksam	*(attention)*
	zielorientiert	*(goal-focus)*
	konzentriert	*(concentration)*
"Self-control depletion"	erschöpft*	*(depletion)**
	beansprucht	*(exhaustion)*
	abgespannt	*(debilitation)*
	energielos	*(energy)*
	entmutigt	*(inertness)*
	antriebslos	*(fatigue)*

Note. These translations (in parentheses) have yet to be validated. *Category labels that were displayed in the upper screen corners. In German IATs, verbs are used for items rather than nouns. Most English IATs use nouns rather than verbs as items. I have adjusted the translations to take this difference into account.

Eidesstattliche Erklärung

Ich erkläre an Eides statt, dass ich die der Fakultät TUM School of Management der Technischen Universität München zur Promotionsprüfung vorgelegte Arbeit mit dem Titel:

Fear-Induced Self-Control Depletion:
Effects of State Fear and Trait Self-Control on Subsequent Self-Controlled Behavior and Motivation

am Lehrstuhl für Psychologie unter der Anleitung und Betreuung durch
Prof. Dr. Hugo M. Kehr ohne sonstige Hilfe erstellt und bei der Abfassung nur die gemäß § 6 Abs. 6 und 7 Satz 2 angegebenen Hilfsmittel benutzt habe.

Ich habe keine Organisation eingeschaltet, die gegen Entgelt Betreuerinnen und Betreuer für die Anfertigung von Dissertationen sucht, oder die mir obliegenden Pflichten hinsichtlich der Prüfungsleistungen für mich ganz oder teilweise erledigt.

Ich habe die Dissertation in dieser oder ähnlicher Form in keinem anderen Prüfungsverfahren als Prüfungsleistung vorgelegt.

Ich habe den angestrebten Doktorgrad noch nicht erworben und bin nicht in einem früheren Promotionsverfahren für den angestrebten Doktorgrad endgültig gescheitert.

Die öffentlich zugängliche Promotionsordnung der TUM ist mir bekannt, insbesondere habe ich die Bedeutung von § 28 (Nichtigkeit der Promotion) und § 29 (Entzug des Doktorgrades) zur Kenntnis genommen. Ich bin mir der Konsequenzen einer falschen Eidesstattlichen Erklärung bewusst.

München, den 12.08.2013