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Regulatory Accessibility and Social Influences on State Self-Control

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Abstract

The current work examined how social factors influence self-control. Current conceptions of state self-control treat it largely as a function of regulatory capacity. The authors propose that state self-control might also be influenced by social factors because of regulatory accessibility. Studies 1 through 4 provide evidence that individuals' state self-control is influenced by the trait and state self-control of salient others such that thinking of others with good trait or state self-control leads to increases in state self-control and thinking of others with bad trait or state self-control leads to decreases in state self-control. Study 5 provides evidence that the salience of significant others influences both regulatory accessibility and state self-control. Combined, these studies suggest that the effects of social influences on state self-control occur through multiple mechanisms.

Keywords

self-control; self-regulation; accessibility; social influences; social cognition

Lay accounts of self-control are highly individualistic. When people exercise self-control, others look to their positive traits to explain their success. When people fail to exert self-control, others assume some personal flaw prevents them from being able to manage their behavior. Psychological models address these individual effects of self-control in models of trait self-control (Mischel, Shoda, & Peake, 1988; Tangney, Baumeister, & Boone, 2004). However, social psychologists have also highlighted that state self-control is likely to be influenced by a variety of situational factors (Baumeister, Bratlavsky, Muraven, & Tice, 1998; Mischel & Baker, 1975; Mischel, Ebbesen, & Zeiss, 1972). Recently, social psychologists have begun to investigate the direct impact of social factors on individuals' self-control. Across many studies, researchers have concluded that individuals' state self-control may be reduced because of demanding interpersonal interactions (Finkel et al., 2006; Richeson & Trawalter, 2005; Vohs, Baumeister, & Ciarocco, 2005).

Self-control has been defined as inhibition of an automatic impulse (Baumeister et al., 1998). However, effortful activation of behaviors may also require self-control (Fishbach & Trope, 2005; Muraven, Tice, & Baumeister, 1998). We adopt a definition of self-control that

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includes both inhibition and activation and define self-control as engaging in a behavior with short-term costs (e.g., it is unpleasant) because of a benefit that it might provide or inhibiting a desired behavior because of costs it might also accrue (Fishbach, Friedman, & Kruglanski, 2003; Fujita, Trope, Liberman, & Levin-Sagi, 2006; Mischel et al., 1988). Benefits reaped and costs avoided may be temporally distal or proximal. For example, a student who skips a party to study might experience the long-term benefit of good grades and job recommendations. More immediately, that student might experience positive feelings toward the self because of progress made toward a goal (Carver & Scheier, 1990).

Because self-control is a behavior that typically moves someone toward a goal, it is important to distinguish it from the broader class of behaviors that might be considered goal pursuit or self-regulation. The key element of self-control that distinguishes it from its counterpart of goal pursuit is that self-control involves a conflict between desires, with each desire leading to potential costs and benefits. Because self-control requires this conflict, the same behaviors will not demand self-control of all people. Take, for instance, two friends who share a goal of losing weight and meet for lunch at a restaurant known for its fantastic french fries. One friend loves french fries and has to override her desire for them when ordering her meal. The other friend doesn't like french fries and so it is not as difficult for her to pass them up. By avoiding french fries, both friends have pursued their goal of weight loss, but only one has exerted self-control.

An extensive line of research treats capacity for self-control as a resource that can be depleted through use, reserved for later use, and restored (Baumeister, Gailliot, DeWall, & Oeten, 2006; Muraven & Baumeister, 2000; Muraven, Shmueli, & Burkley, 2006). When people exert self-control, they expend some of this resource, leaving less available for later demands (Muraven et al., 1998). A variety of activities spanning multiple domains consume this resource, including emotion regulation, attention regulation, thought suppression, behavioral regulation, impulse control, and resisting temptations (Baumeister et al., 1998; Muraven et al., 1998; Schmeichel, Vohs, & Baumeister, 2003; Vohs & Heatherton, 2000). Furthermore, performance on a wide variety of tasks is impaired when regulatory resources are limited. Individuals with limited regulatory resources are less likely to persist on both mental and physical tasks (Ciarocco, Sommer, & Baumeister, 2001; Vohs & Heatherton, 2000) and are more likely to spend money impulsively, act aggressively, and fail to regulate their emotions (Baumeister et al., 1998; DeWall, Baumeister, Stillman, & Gailliot, 2007; Vohs & Faber, 2007). A key feature of the resource-depletion framework is that self-control draws on a generic resource so that exerting control in one domain leads to deficits in ability to exert control in any other domain. Thus, following a diet leads to increased emotional irritability just as resisting the temptation to snap at a coworker leads to dieting failures.

Research inspired by this model has demonstrated that successful interactions with others take a great deal of self-control. Interacting with irritating individuals and individuals who require help in attaining a goal leads to decreased regulatory capacity (Finkel et al., 2006). Capacity for self-control may also decrease after interacting with others who fall into stereotyped groups (Richeson & Trawalter, 2005). More generally, social interactions may decrease regulatory capacity because of demands on individuals to engage in self-presentation (Vohs et al., 2005). In each of these situations, individuals regulate their own behaviors, speech, or expressions in order to facilitate harmonious interpersonal interactions. Although social context influences state self-control, it does so by requiring individuals to exert self-control.

The resource-depletion model focuses exclusively on state self-control as a function of capacity—the extent to which regulatory resources are available. However, understanding how social factors affect regulatory exertion requires considering other mechanisms that

might influence state self- control. In a pertinent series of studies, participants who took the perspective of another person who was exerting self-control evidenced decreased state self-control themselves (Ackerman, Goldstein, Shapiro, & Bargh, 2009). In contrast, participants who merely thought about someone else who was exerting self-control (without taking his or her perspective) evidenced *greater* self-control than did participants who thought about a control other. Although the purpose of these studies was to investigate vicarious depletion that might arise through perspective taking, they highlight the need to understand how social factors affect state self-control through mechanisms other than regulatory depletion. In these studies, merely taking the perspective of someone who was depleted led participants to show decreased state self-control. This decrease in self-control cannot be explained by a previous expense of regulatory resources. Furthermore, these studies point to the potential for social factors to increase state self-control. We build on these studies by investigating a social-cognitive mechanism that would explain why social factors may at times lead to increases and decreases in state self-control.

At any moment in time, individuals vary in the likelihood and extent to which they will exert self-control. State self-control differs from trait self-control in that it is highly subject to situational influences. We expect that influences on state self-control can be organized into multiple sources, including internal factors as well as social and environmental influences. In this article we focus on social influences on state self-control. Individuals' behavior changes across social environments (Zajonc, 1965). People may change their attitudes or behaviors in order to gain social approval (Deutsch & Gerard, 1955) or they may perform better because of increased arousal (Blascovich, Mendes, Hunter, & Salomon, 1999). In addition, people's behaviors are influenced by the thoughts and ideas that their social environment makes accessible (Fitzsimons & Bargh, 2003; Shah, 2003). We test the hypothesis that one mechanism by which individuals influence the self-control of others is by increasing the accessibility of behaviors and constructs associated with self-control.

Social psychological perspectives on accessibility provide a rich source of information about the ways that cognitions might influence state self-control. Accessibility is defined as the readiness with which constructs might be used in information processing (Bruner, 1957) and is contrasted with availability, which involves the presence of cognitive constructs (Higgins, King, & Mavin, 1982). Greater accessibility of constructs leads to increased accessibility of related constructs (Collins & Loftus, 1975) as well as behaviors in line with those constructs (Fishbach et al., 2003; Fishbach & Shah, 2006).

Research on goal pursuit complements the resource-depletion approach to self-control and suggests that accessibility is likely to influence state self-control. This approach is marked by a treatment of goals as knowledge structures (Shah, Kruglanski, & Friedman, 2002). Goals are associated in memory with a wide range of related concepts, including means that might be used to reach the goals, temptations, subgoals, and affect (Fishbach, Dhar, & Zhang, 2006; Fishbach et al., 2003; Fishbach, Shah, & Kruglanski, 2004; Shah & Kruglanski, 2003). Interpersonal relationships, and the goals associated with them, are also incorporated into the goal system (Fitzsimons, Shah, Chartrand, & Bargh, 2005). When significant others become salient, pursuit of goals associated with them increases (Aarts, Gollwitzer, & Hassin, 2004; Fitzsimons & Bargh, 2003; Shah, 2003).

Drawing from this work, we expect that regulatory accessibility—the extent to which individuals might incorporate self-control into information processing—influences state self-control. Salient thoughts about self-control (e.g., thinking about willpower, watching others resist a temptation) result from increased regulatory accessibility and should lead to an increase in regulatory exertion. Decreased regulatory accessibility involves the activation of constructs that are not conducive to exerting self-control (e.g., yielding to temptations,

acting impulsively) and should lead to decreased regulatory exertion. Importantly, this work also points to how salient others might influence self-control. That is, individuals might influence the self-control of others not only by demanding that they exert self-control during the interaction (Finkel et al., 2006), but also by influencing the salience of thoughts of exerting self-control.

This idea that individuals might be more likely to exert self-control after thinking about others who have done so is built on models of contagion that explain how phenomena spread from one person to another. The spread of activation involves the perception of a behavior by others, the interpretation of that behavior, and the thoughts of oneself performing that behavior (Carver, Ganellen, Froming, & Chambers, 1983). Similarly, mimicry relies on the perception-behavior link (Bargh, Chen, & Burrows, 1996) such that when people perceive behaviors, the schemas for those behaviors become activated, thereby increasing the likelihood that the perceiver will enact similar behaviors (Chartrand & Bargh, 1999). Likewise, goal (Aarts et al., 2004; Dik & Aarts, 2007), attitude (Sinclair & Huntsinger, 2006; Sinclair, Lowery, Hardin, & Colangelo, 2005), and mood (Neumann & Strack, 2000) contagion involve increased accessibility of schemas that lead to corresponding cognition and emotions. We expect that state self-control might spread from one individual to another in a similar fashion. Witnessing others exerting self-control or thinking about others who chronically exert self-control should lead to increased thoughts of self-control and increased regulatory exertion.

Importantly, this work on contagion focuses on *specific* attitudes, goals, and emotions. When people think of others who want them to be analytical, they become more analytical (Shah, 2003). When they think about others who increase a helping goal, they become more helpful (Fitzsimons & Bargh, 2003). Thinking of others who have goals to earn money leads to increased efforts to earn money (Aarts et al., 2004), and thinking of others with drug-related motivations increases the accessibility of drugs and substance use (Leander, Shah, & Chartrand, 2009). Some work has begun to consider the fact that salient others might influence state self-control more generally. For instance, Martijn et al. (2007) primed participants with an exemplar demonstrating persistence and diligence. This prime increased persistence among participants who had limited regulatory capacity. Yet, even in this study, the dependent measure of self-control (persistence on physical handgrip task) matched the domain in which the exemplar (an Olympic athlete) likely exerted self-control.

To date, no research has investigated whether social influences increase the accessibility of self-control more generally. We expect that regulatory accessibility—like regulatory capacity—is generic. That is, when others who are good at self-control are salient, behaviors and strategies for self-control also become more salient. This increased regulatory accessibility should lead to increased regulatory exertion in any domain. In contrast to the goal pursuit literature, in which the focus is on how watching others pursue a goal leads to increased goal pursuit in that domain, we suggest that regulatory accessibility involves the salience of general behavioral strategies. Increased regulatory accessibility should lead to self-control in any domain regardless of which specific behavior or goal pursuit led to its increase. We would therefore predict that watching somebody exert self-control in one domain should increase self-control in that domain *and* in any other domain of goal pursuit. That is, watching somebody resist cookies might lead somebody to exert self-control in their interpersonal relationships, or vice versa.

Currently, there is some evidence that regulatory accessibility at a general level leads to increased state self-control. In a study on prejudice reduction, individuals primed with words related to self-control were less likely to express negative stereotypes about others (Araya, Akrami, Ekehammar, & Hedlund, 2002). In another study, self-control priming aided

depleted participants in exerting self-control on a physical persistence task (Alberts, Martijn, Greb, Merckelbach, & deVries, 2007). We extend this reasoning to suggest that social factors influence regulatory exertion by increasing (or decreasing) the accessibility of behaviors related to self-control at a general level and influence state self-control.

The Current Studies

The current studies were designed to test a set of hypotheses about how social influences affect regulatory accessibility and exertion. First, we expect that social environment will influence the extent to which people exert self-control such that their state self-control will correspond to the self-control of salient others. Second, we expect that this accessibility will not be domain specific. That is, individuals will be more likely to exert self-control on a given task even when others salient to them exerted self-control on dissimilar tasks. Similarly, we expect that increasing the saliency of others' self-control at a general level will influence specific acts of regulatory exertion. Finally, we test the hypothesis that these social influences occur because they affect regulatory accessibility.

Study 1

Our first step in examining how social factors influence regulatory exertion was to test the hypothesis that thinking about others' self-control influences the extent to which participants demonstrate state self-control. In this study, we asked participants to think about a friend who had either good or bad self-control. We expected that participants who thought about a friend with good self-control would evidence greater state self-control than those who thought about a friend with bad self-control.

Method

Participants: A total of 36 participants (21 females) were recruited from a community pool of individuals interested in participating in experiments for cash compensation. All participants were between the ages of 18 and 25 and received $5 for their participation.

Procedures: Participants were recruited for a study on memories of their social relationships. When participants arrived, a female experimenter timed their persistence on a handgrip task (Muraven et al., 1998). Next, participants completed a computerized writing task in which they were randomly assigned to think of a friend from college who had good self-control or who had bad self-control. Participants answered four questions about this person (e.g., What is this person's name? Is this person a male or female?). They next recalled an incident in which this person expressed this good or bad self-control and answered several questions about the incident (e.g., What season was it? What time of day was it?). Finally, they briefly described the incident. After completing a measure of state positive and negative affect (Watson, Clark, & Tellegen, 1988), participants completed the handgrip persistence task again.

Results and Discussion—The primary dependent variable of interest was change in persistence on the handgrip task after the writing manipulation. A repeated measures analysis of variance (ANOVA) examining the effect of writing condition on handgrip persistence yielded a significant interaction between time and condition, $F(1, 34) = 5.28$, $p < .05$. As the means in Table 1 reveal, participants who wrote about a friend with good self-control did not demonstrate decreased handgrip persistence after the writing task, $t(35) = 1.32$, $p > .10$. Participants who wrote about a friend with bad self-control, however, persisted for less time on the second handgrip task than on the first, $t(35) = -2.94$, $p < .01$. Assignment to condition did not contribute to differences in either positive affect, $t(34) = -1.13$, $p = .27$, or negative affect, $t(34) = 0.66$, $p = .51$.

Importantly, we do not know what amount of handgrip persistence might have occurred had individuals not thought about social figures who were good at or bad at self-control. Past research has shown a small but nonsignificant decrease in persistence among individuals in a pure control condition (Muraven et al., 1998). Thus, the fact that participants in our study who wrote about a friend with good self-control did not demonstrate a statistically significant increase in persistence does not necessarily imply that there is not a benefit of writing about a friend with good self-control. We cannot conclude from this study whether these effects were driven by decreased state self-control by those who thought about a friend with bad self-control or increased state self-control by those who thought about a friend with good self-control.

These results provide initial evidence that the salience of others influences the regulatory exertion of individuals on unrelated tasks. Most importantly, these differences in regulatory exertion emerged despite the fact that neither writing condition should have consumed more regulatory resources. Furthermore, writing condition did not lead to differences in either positive or negative affect.

Evidence from this study points to an alternative mechanism of influence. One plausible mechanism may be regulatory accessibility. That is, thinking of someone with good trait self-control may have increased thoughts about and behaviors related to self-control. Thinking about a friend with bad trait self-control may have increased the accessibility of thoughts and behaviors counterproductive to self-control. In turn, this accessibility may have influenced state self-control on the handgrip task.

Study 2

Building on Study 1, Study 2 tested whether state self-control is influenced by the state (rather than trait) self-control of others. Consistent with the findings from Study 1, we expected that watching others behave in ways that require self-control would increase the extent to which individuals will exert self-control themselves.

Method

Participants: A total of 72 participants were recruited to participate in a taste-testing study. All participants were undergraduate students and either received cash or research credit for their participation in the study. Data from 1 participant were lost, leaving an analysis sample of 71 participants.

Procedure: Participants were asked not to eat anything for 2 hours prior to the study. Upon arrival, participants were randomly assigned to two experimental manipulations. First, they were assigned to either a difficult or easy self-control condition. All participants were presented with two plates of food: a plate of freshly baked chocolate chip cookies and a plate of carrot sticks. Participants assigned to the difficult self-control condition were instructed to eat the carrots and refrain from eating the cookies, whereas participants assigned to the easy self-control condition were instructed to eat the cookies and refrain from eating the carrots (Baumeister et al., 1998; Segerstrom & Nes, 2007).

Additionally, participants were assigned to either an actor (taste-tester) or observer role. Actors were seated in front of the plates of food and completed the taste-testing task; observers were asked to stand a few feet away and were told that their job was to watch the actor complete the taste-testing task. Actors and observers received their instructions for the task individually. The instructions were repeated once both actors and observers were in the experimental room. All participants were instructed not to talk to each other but to perform their respective tasks. The task lasted 4 minutes.

Participants next completed two trials of a Stroop task. This task, commonly used to measure inhibitory capacity (e.g., Muraven et al., 2006), involves reading the color of the ink with which words are printed. The task becomes difficult because the words printed are color words (e.g., *red*, *green*, *blue*) that do not correspond to the color of the ink in which they are printed. Individuals who suppress the distraction of the words' meaning and more quickly read the color of the words' ink evidence greater self-control. For all participants, the first trial contained 44 congruent trials (semantic meaning and ink color match) and the second trial contained 44 incongruent trials (semantic meaning and ink color did not match). Participants were told to read the ink color of the words presented on the cards as quickly and accurately as possible. Due to an experimenter error, we did not accurately record the number of mistakes that participants made on the Stroop task. Therefore, the dependent variable of interest was the difference between the time in seconds that it took participants to read the incongruent and congruent cards. Longer times indicate that participants were more distracted by the incongruent trials and represent less state self-control than shorter times. Actors and observers waited in the hall while their counterpart completed the Stroop task. Following the Stroop task, actors rated how interesting, important, and difficult the task was and observers rated how interesting the task was, how difficult they thought it must have been for the actor, and how responsible they felt for the actor's behavior. Finally, all participants completed a scale designed to measure self-reported regulatory capacity. This measure asked participants to report the extent to which they felt each of 11 different states (e.g., unmotivated, stressed, distracted/preoccupied) on a 4-point scale anchored by *not at all* and *extremely*.

Results and Discussion—We conducted a 2 (self-control: difficult, easy) × 2 (role: actor, observer) ANOVA on the difference in time it took participants to read the incongruent and congruent Stroop cards. This analysis revealed a significant interaction between self-control and role conditions, $F(1, 67) = 4.08$, $p < .05$. As Figure 1 shows, this interaction was driven by poorer performance on the Stroop task by observers who watched others eat cookies compared to observers who watched others eat carrots, $F(1, 67) = 6.03$, $p < .05$, $d = .63$. Observers of cookie-eaters spent more time on the incongruent Stroop trials than did observers of carrot-eaters. There were no differences in performance on the Stroop task between actors who ate carrots and actors who ate cookies, $F(1, 67) = 0.06$, $p > .80$, $d = -.06$.

In this study, observers were merely asked to watch others eat carrots or cookies. The fact that the taste-testers may have been exerting self-control was not made explicitly salient. However, simply watching someone resist cookies and eat carrots led to increased inhibitory performance among observers. Furthermore, observers of carrot-eaters rated the task as more difficult for the actor than observers of cookie-eaters, $F(1,33) = 16.50$, $p < .001$, suggesting that observers recognized that carrot-eaters had exerted more self-control than cookie-eaters.

There is no evidence that the state self-control of observers was influenced by a regulatory capacity mechanism. First, observers were equally exposed to the aroma and sight of freshly baked cookies. To the extent that these sensory experiences caused resource depletion, the depletion should have been equivalent across experimental conditions. Second, observers of cookie-eaters did not differ from observers of carrot-eaters in their self-reported regulatory capacity, $t(33) = -1.36$, $p = .18$. Third, observers of cookie-eaters did not differ from observers of carrot-eaters in reported interest in the task, $F(1, 33) = 0.33$, $p = .57$. Had the task required more self-control by observers of cookie-eaters, we might have expected them to report increased interest in the experimental task (Fishbach & Trope, 2005). Furthermore, observers of carrot-eaters did not report more perceived responsibility for the actor's performance on the task than did observers of cookie-eaters, $F(1, 33) = 0.29$, $p = .59$.

Perceived responsibility has been connected to empathy and is associated with feelings of vicarious experience (Ackerman et al., 2009; Pronin, Wegner, McCarthy, & Rodriguez, 2006). Given that observers of cookie-eaters and observers of carrot-eaters did not differ in how much responsibility they felt for the actor's behaviors, we have little evidence to suggest that the effects we see were influenced by vicarious feelings of resource-depletion.

The most important result of this study is that the pattern of results for actors and observers differed. One result that may seem surprising is that actors did not demonstrate the traditional resource-depletion effect. The resource-depletion model would have predicted that individuals who resisted cookies would demonstrate decreased performance on the Stroop task. Our study, however, differed from resource-depletion studies because the initial act of self-control was public. Our findings are consistent with research suggesting that the amount of self-control required by difficult tasks is reduced by the presence of others (Fishbach & Trope, 2005). Given that the actors in our study exerted self-control under the watchful eye of the observers, we are not surprised by the nonsignificant depletion effect. Importantly, our results suggest that actors did not have to actually use self-regulatory resources in order for observers to be affected by their behavior. In fact, in this case, observers benefitted from a behavior that did not cost the actors.

The results of Study 2 extend those from Study 1 and suggest that one factor that influences an individuals' ability to exert self-control is their recent exposure to others who have exerted self-control. Importantly, our results do not suggest that individuals suffer vicariously from merely watching others exert self-control. Rather, the findings support our hypothesis that social factors might affect self-control by influencing regulatory accessibility.

Study 3

The purpose of Study 3 was to investigate whether social factors affect state self-control automatically. Studies 1 and 2 demonstrated that recognizing the state and trait self-control of others leads to similar levels of state self-control in participants. In this study, we draw from social-cognitive models of transference and goal pursuit. Findings from these models suggest that individuals encode information about significant others (Anderson & Cole, 1990; Shah, 2003). Given that these significant-other representations are highly accessible (Anderson, Glassman, Chen, & Cole, 1995), we expected that priming individuals with the name of a significant other who was either good or bad at self-control would affect the likelihood that participants would exert self-control.

Method

Participants: A total of 42 participants (21 females) were recruited from the Duke University psychology participant pool and compensated with credit toward a research participation requirement.

Procedures: Participants were recruited for a study on brainstorming. Upon arriving at the laboratory, participants were prompted by a computer screen to input the first names of several significant others. One of these questions asked participants to think of someone who has very good self-control (e.g., is motivated, is good at resisting temptations) and another asked participants to think of someone who has very bad self-control (e.g., is bad at resisting temptations, is unmotivated). Because individuals may differ in chronic accessibility of individuals with good and bad self-control, we also measured how long it took participants to think of a person with good self-control and a person with bad self-control. We expected that such chronic accessibility might affect the extent to which priming affected individuals' behaviors. Finally, in order to make it appear that there was a

reason we asked participants about their friends, we also asked them to rate how close they were to each friend.

After completing a filler task of questionnaires, and following the procedures used by Shah (2003), participants were told that the ability to quickly recognize words is related to brainstorming and that we would measure how quickly they could determine whether presented strings of letters were words or nonwords. *In reality, we used a lexical decision task to deliver a subliminal priming manipulation. The task used neutral words (e.g., also*, *locks*, *passage*) and nonwords (e.g., *suunsla*, *cklu*, *mosdel*). Prior to the presentation of each target, individuals were primed with either the name of the person they had indicated was good at self-control or the person they had indicated was bad at self-control. These primes appeared for 10 milliseconds each and were masked immediately afterwards with a series of asterisks. The computer presented the same name before each of 12 trials.

Following the subliminal priming task, participants worked on items from the Remote Associates Test (RAT; Mednick, 1962). On the RAT, participants see three words and are asked to come up with a fourth word that unites the three presented. For instance, a participant shown the words *elephant*, *lapse*, and *vivid* might come up with the word *memory*. Participants were presented with 15 difficult RAT items (see McFarlin, Baumeister, & Blascovich, 1984, for the items used). They were able to give up on items at any time, but were unable to return to any item once they had continued to the next. The computer software recorded time spent on each item. Our dependent variable of interest was total time spent persisting on the RAT test.[1]

Results and Discussion—There was a marginally significant effect of condition on persistence on the RAT, $F(1, 40) = 2.73$, $p = .10$, $d = .51$. Participants who were primed with the name of a friend who was good at self-control ($M = 3.49$, $SD = 1.57$) persisted longer than participants who were primed with the name of a friend who was bad at self-control ($M = 2.79$, $SD = 1.15$). This effect became significant after controlling for chronic accessibility of the significant other used in the priming task, $F(1, 39) = 4.15$, $p = .05$. Condition did not predict how long it took people to think of a friend with good or bad self-control, $F(1, 41) = 0.26$, $p = .61$.

One explanation for these results is that participants were thinking about people they think of as generally good and people they think of as generally bad. The fact that our social primes also are consistent with general evaluation may explain why participants who were primed with a friend with good self-control demonstrated greater state self-control than those who wrote about a friend with bad self-control. Although our protocol included no measures of general evaluation for the social prime, we reasoned that an item assessing self-reported closeness of participants to their prime would serve as a suitable proxy. We found no difference in closeness between priming conditions, $F(1, 42) = 0.71$, $p = .41$. Had participants preferred their friends with good self-control, we would have expected to see them report being closer to these friends as well.

In this study, we showed that individuals may be unaware of the social influences that affect them. Our primes were presented subliminally, suggesting that the influence of significant

[1]Because state self-control could be evidenced both by performance (i.e., getting answers correct, and potentially quickly) and persistence (i.e., working for a long time on the word problems), we would have preferred to use a composite measure of both performance and persistence. In this study, however, assignment to condition drastically affected the size of the relationship between persistence and performance. For those who had been primed with the name of a friend with good self-control, the correlation between persistence and performance was $r(21) = .71$, $p < .001$, whereas for those who had been primed with the name of a friend with bad self-control, the correlation was $r(21) = .20$, $p = .38$. Because of this inconsistency, we felt it inappropriate to create a composite. Assignment to condition in this study did not affect performance on the RAT test, $F(2, 39) = .05$, $p > .50$.

others with good or bad self-control only requires activation of their representation in memory (Shah, 2003). An advantage of Study 3 is that the subliminal priming manipulation allowed us to manipulate only the social factor, without making explicit reference to behaviors related to self-control. Whereas participants in Studies 1 and 2 were both thinking about a social factor and how that social factor involved behaviors related to self-control, in Study 3, participants were only primed with the name of a person. Nonetheless, the results are consistent with results from Studies 1 and 2.

Study 4

The purpose of Study 4 was to examine how social factors might carry both costs and benefits for self-control. Sometimes salient others may lead to increases in self-control, whereas at other times they may lead to decreases. We also included a control condition to evaluate whether the effects we observed in Studies 1, 2, and 3 were attributable to the costs of thinking about somebody with bad trait self-control, the benefits of thinking about somebody with good trait self-control, or both.

Method

Participants: A total of 112 (70 females) participants were recruited through the Duke University psychology undergraduate pool and compensated with credit toward completing a research participation requirement.

Procedures: Participants arrived at the lab and completed a writing task similar to the one used in Study 1. They were randomly assigned to write about one of three friends: a friend who was good at self-control, a friend who was bad at self-control, or a friend who was moderately extraverted.

Next, participants completed a Stroop task identical to that used in Study 2. In addition to time spent on each set of trials, we measured the number of errors made on incongruent trials. Because participants could have exerted self-control by either working through the task quickly or by being cautious and avoiding errors, we created a dependent variable that was a composite of standardized speed and accuracy on the Stroop task ($r = .22$). Higher scores indicate that participants took longer on the task and made more mistakes; therefore, higher scores represent less state self-control.

Results and Discussion—We examined the influence of writing condition on Stroop performance using ANOVA. After controlling for an unexpected effect of gender, a marginally significant effect of writing condition emerged, $F(2, 108) = 2.46$, $p = .09$. Consistent with Studies 1, 2, and 3, participants who wrote about a friend with good self-control ($M = -0.16$, $SD = 0.67$), performed better than did those who wrote about a friend with bad self-control ($M = 0.20$, $SD = 0.75$), $F(1, 108) = 4.88$, $p < .03$, $d = .44$. Individuals who wrote about a friend with moderate extraversion fell between those who wrote about a friend with good and bad self-control ($M = 0.00$, $SD = 0.91$). Although neither those who wrote about a friend with good self-control or those who wrote about a friend with bad self-control differed from those who wrote about a friend with moderate extraversion, ps > .20, we conducted a linear trend analysis aimed to determine whether the differences between moderate extraversion condition and the good and bad self-control conditions were equivalent and found a significant linear trend (and no quadratic trend, $p = .83$), $F(1, 108) = 4.92$, $p < .03$.

By including a control condition in this study, we were able to examine the relative costs and benefits of how salient others influence regulatory exertion. Our findings suggest that the effects we present in Studies 1 through 3 cannot be attributed to only a decrease in state

self-control when salient others highlight poor self-control or to only an increase in state self-control when salient others highlight good self-control. Rather, the differences we observed when social others highlight good self-control as compared to bad self-control appear to be a combination of small differences in both directions from a state in which self-control is not salient.

Study 5

Our final step was to test the hypothesis that social factors influence regulatory accessibility and, in turn, regulatory exertion. Building on Studies 1 through 4, this study included a full design—a manipulation of salience of social environment, a measurement of regulatory accessibility, and a measurement of regulatory exertion—and allowed us to test the hypothesis that social factors influence regulatory accessibility and regulatory exertion. Consistent with Studies 1 through 4, we expected that increasing the salience of a significant other with good self-control would lead to increased regulatory accessibility and exertion and that increasing the salience of a significant other with bad self-control would decrease regulatory accessibility and exertion.

Method

Participants: A total of 117 participants (55 females) were recruited from the Duke University psychology participant pool and compensated with credit toward a research participation requirement.

Procedures: Participants were recruited for a study on brainstorming. As in Study 4, participants were randomly assigned to write about a friend with good self-control, bad self-control, or moderate levels of extraversion.

Following this writing task, participants completed a lexical decision task in which they were asked to identify whether target strings of letters were words or nonwords by pressing marked keys on a keyboard. Half of the targets were nonwords and half were words. The task included neutral words (*cotton*, *description*, *hobby*, *interpret*, *occasion*, *panel*, *perspective*, *stranger*, *vinyl*, *warranty*, *water*), words related to exerting self-control (*achieve*, *discipline*, *effort*, *intention*, *motivation*, *persist*, *resist*, *success*, *willpower*), and words related to a lack of self-control (*distraction*, *temptation*, *indulge*). We discarded trials in which errors were made as well as responses quicker than 300 milliseconds and slower than 2,000 milliseconds and log-transformed the data to correct for a positive skew (Fazio, 1990). This left us with 97.73% of the original responses.

After the lexical decision task, participants completed the same RAT task used in Study 3. Again, the computer timed how long participants spent working on the RAT task. In order to account for the fact that the manipulation may have increased both performance (e.g., Schmeichel et al., 2003) and persistence (e.g., Baumeister et al., 1998), we also investigated whether condition affected a composite of performance and persistence. In order to create these variables, we standardized each variable and averaged across them. Although the variables were significantly correlated ($r = .37$), the correlation was modest, suggesting that some participants may have exerted self-control by performing well, whereas others may have exerted self-control by persisting longer on the items.

Results and Discussion

Regulatory exertion: We examined the effect of writing condition using a one-way ANOVA with three levels (good self-control, bad self-control, moderate extraversion). As expected, assignment to writing condition predicted persistence on the RAT task, $F(2, 112) = 3.34$, $p = .04$, and marginally predicted performance on the RAT task, $F(2, 112) = 2.47$, p

= .09. Furthermore, condition predicted the composite of performance and persistence on the RAT task, $F(2, 113) = 4.55$, $p = .03$. Means and standard deviations for each condition are presented in Table 2. As in Study 4, the pattern of means was linear, as indicated by a significant linear trend (and nonsignificant quadratic trends, ps > .90), for persistence, $F(1, 112) = 6.74$, $p = .01$, performance, $F(1, 112) = 4.95$, $p = .03$, and the composite of persistence and performance, $F(1, 112) = 9.17$, $p < .01$.[2] As in Studies 1 through 4, individuals who brought to mind others whom they perceive as high in self-control demonstrated more regulatory exertion than individuals who brought to mind others whom they perceive as low in self-control.

Regulatory accessibility: In order to examine the influence of writing condition on regulatory accessibility, we used a repeated measures ANOVA with target (positive self-control words, negative self-control words) as a within-subjects variable and writing condition as a between-subjects variable. After controlling for neutral word accessibility, we found a significant interaction between target and condition, $F(2, 111) = 4.21$, $p < .02$. As Table 3 shows, individuals who wrote about a friend with good self-control were quicker to recognize words related to exerting self-control than they were to recognize words related to a lack of self-control, $t(111) = -.32$, $p < .01$. Although participants who wrote about a moderately extraverted friend also recognized words related to self-control more quickly than words related to a lack of self-control, $t(111) = -.21$, $p < .05$, participants who wrote about a friend with bad self-control did not, $t(111) = -1.11$, $p > .25$. Furthermore, participants who wrote about a friend with good self-control demonstrated greater accessibility of words reflecting self-control than participants who wrote about a moderately extraverted friend, $F(1, 113) = 3.08$, $p = .08$; the groups did not differ on the accessibility of words related to a lack of self-control, $F(1, 113) = 0.11$, $p = .74$. Participants who wrote about a friend with bad self-control did not differ from participants who wrote about a friend with moderate extraversion on either the accessibility of words related to self-control, $F(1, 113) = 0.07$, $p = .80$, or words related to a lack of self-control, $F(1, 113) = 0.14$, $p = .71$. Thus, the effects of regulatory accessibility seem to be largely driven by participants who wrote about a friend with good self-control.

Further confirming our hypothesis, the accessibility of words related to exerting self-control predicted the composite of persistence and performance on the RAT, $B = -1.09$, $p < .05$, such that participants with greater accessibility (shorter reaction times) persisted longer and performed better on the RAT task.

Mediational analysis: We used a meditational analysis to examine how the salience of significant others indirectly influences regulatory exertion through the mechanism of regulatory accessibility. Because the activity in regulatory accessibility was driven by those who had written about a friend with good self-control, in the mediational analysis, we compared this group to both other conditions combined. We dummy coded a variable to represent those who wrote about a friend with good self-control compared to those who wrote about a friend with bad self-control or a friend with moderate levels of extraversion. The mediator variable was speed at recognizing words related to exerting self-control. Because the strongest effects had been found using the composite of persistence and performance, we used the composite variable as the dependent variable in the mediational analysis.

[2]For the composite dependent variable, the pairwise comparisons between those who wrote about a friend with good or bad self-control and the control condition were in the predicted direction and marginally significant, $F(1, 112) = 2.46$, $p = .06$ for bad self-control and $F(1, 112) = 2.12$, $p = .08$ for good self-control (one-tailed, directional tests).

Traditional methods of mediation involve estimating the product term between the effect of the independent variable on the mediator and the effect of the mediator on the dependent variable after controlling for the independent variable. However, significance tests of this product term that use the Sobel standard error are underpowered in real data (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). Because of this, we followed the recommendations suggested by MacKinnon, Lockwood, and Williams (2004) and estimated the confidence intervals around the product term rather than estimating the product term itself. Using the standard errors from our initial model, we generated 200,000 simulations of the potential mediational effect. The 95% confidence limits generated by this approach indicate the size of the mediational product term was between −.10 and .00, $Z_{\alpha}Z_{\beta} = 1.64$, $p = .06$. This finding indicates that regulatory accessibility is a partial mediator of the effect of social influences on regulatory exertion.

As we expected, social factors influenced regulatory accessibility. The difference between recognition of positive and negative words related to self-control was largest for participants who wrote about a friend with good self-control and smallest for those who wrote about a friend with bad self-control. Furthermore, we found additional support for our hypothesis that social influences affect regulatory exertion and identified that these differences in regulatory exertion are partially mediated by regulatory accessibility. Importantly, this effect seems to be attributable primarily to those who wrote about a friend with good self-control.

General Discussion

Together, findings from these studies provide evidence that individuals' state self-control fluctuates in response to their social environment. In three studies, we manipulated social influences using a writing task, in which participants wrote about a friend who was either good or bad at self-control. We also manipulated salience by asking participants to observe other participants who were either exerting or not exerting self-control. Finally, we showed that this effect occurs automatically after subliminal priming. Across these studies, social environment influenced participants' self-control on a variety of tasks requiring self-control including physical persistence, inhibitory capacity, and performance and persistence on difficult word problems.

Findings from these studies suggest that social influences affect state self-control in multiple ways. Past research on resource-depletion has shown repeatedly that interpersonal interactions decrease regulatory capacity by requiring individuals to exert self-control. We produced evidence that state self-control is also affected by regulatory accessibility; that is, state self-control may fluctuate in response to social factors even when exposure to others does not involve the expenditure of regulatory resources.

We also showed that the increases in state self-control due to social factors can be explained, at least in part, by changes in regulatory accessibility. We did not show that social influences decrease state self-control by decreasing regulatory accessibility. Two possibilities might explain this discrepancy between mediation of increases and decreases in self-control. It is possible that negative social influences affect state self-control through an alternative mechanism. Perhaps individuals who see others fail feel less efficacious to succeed themselves or feel less motivated to try to do so themselves in general (Leander, 2009; Symbaluk, Heth, Cameron, & Pierce, 1997). Future research is needed to further understand the situational factors that might explain how good and bad social influences affect state self-control.

Our findings extend recent research by demonstrating that social factors may affect state self-control in multiple ways. In our studies, social factors affected regulatory accessibility, which in turn affected state self-control. At other times, individuals may experience

vicarious depletion from their social interactions (Ackerman et al., 2009). Additional research is needed to understand when regulatory accessibility is more likely to affect state self-control and when vicarious depletion is more likely. We suspect that situations that require perspective taking or situations in which social influences have unsuccessfully attempted to exert self-control will be more likely to lead to vicarious depletion, whereas situations demonstrating successful self-control will be more likely to lead to the regulatory accessibility effects we present here. Future research is needed to examine this hypothesis.

In our work, we operationally defined regulatory accessibility as thinking of many behavioral responses that demonstrate self-control and as quickly recognizing words related to exerting self-control. It is also possible that social factors influence self-control by increasing the accessibility of the costs and benefits associated with behaviors. Because exerting self-control involves a consideration of short- and long-term benefits, as well as costs that might be incurred in order to achieve a long-term benefit, increasing or decreasing the accessibility of these benefits and costs might lead to increased regulatory exertion. Some evidence supports this notion that decreasing the accessibility of short-term benefits improves individuals' ability to exert self-control (Mischel & Baker, 1975; Mischel et al., 1972). Likewise, thinking about the costs associated with exerting self-control may decrease the amount of effort and energy invested in them (Wright & Brehm, 1984). In contrast, increasing the accessibility of long-term costs of failing to engage in self-regulation improves individuals' ability to exert self-control (vanDellen & Hoyle, 2008).

Social interactions with others may also increase regulatory accessibility by increasing processes of self-regulation wherein the individuals' current status and progress are compared to standards. If undesired discrepancies exist, individuals' standards or behaviors are likely to change (Rothbaum, Weisz, & Snyder, 1982). Self-regulation increases in response to challenge arousal (Blascovich et al., 1999), expectation of evaluation (Cottrell, Wack, Sekerak, & Rittle, 1968; Uziel, 2007), and salient personal and normative standards (Carver & Scheier, 1981; Cialdini, Reno, & Kallgren, 1990). By increasing these factors, social interactions increase general self-regulatory processes, as well as the likelihood that regulatory schemas will be accessible.

Although we have focused on regulatory accessibility as a mechanism influencing self-control, other pathways between social factors and self-control should be considered, including motivational mechanisms. Interpersonal relationships are strongly linked with motivation (Shah, 2003), and social factors may increase regulatory motivation. Regulatory motivation may increase if individuals are thinking about an audience that might evaluate them (Baldwin, Carrell, & Lopez, 1990; Baldwin & Holmes, 1987). If the salient audience expects them to exert self-control, they may be more motivated to do so, whereas if the salient audience does not expect them to exert self-control, they might be less likely to do so. Regulatory motivation might have a stronger influence on behavior if individuals perceive that the tasks requiring self-control have implications for social acceptance (Baumeister & Leary, 1995; vanDellen, Hoy, & Hoyle, in press).

The influence of social factors on regulatory accessibility and regulatory exertion most likely occurs automatically. Although individuals may at times become aware of the influence of others on their own behavior, they are not likely to recognize what sorts of thoughts are highly accessible. Because of the automatic nature of these processes, some may ask how much responsibility individuals should bear for their own behaviors. At the extreme, one can imagine criminal cases in which the defense argues that defendants are not accountable for their behaviors because of their social and physical environment. In the framework we present, regulatory exertion is a controlled process, one in which individuals must engage in effortful management of their competing desires (Baumeister et al., 1998).

Rather than using these influences as excuses for their behaviors, individuals should learn how to recognize when they may be at risk for failures of self-control so that they can avoid pitfalls.

At the same time, these studies should challenge the notion that self-control is only an individual struggle. People should be encouraged by the knowledge that their own regulatory behaviors can influence those of others around them. By exerting self-control, people can increase the likelihood that others around them who take note of this will in turn be more able to exert self-control themselves. Likewise, when people consider whether they should exert self-control, they should be aware that failing to do so may not only cost them long-term benefits, but also that it might undermine the success of those around them.

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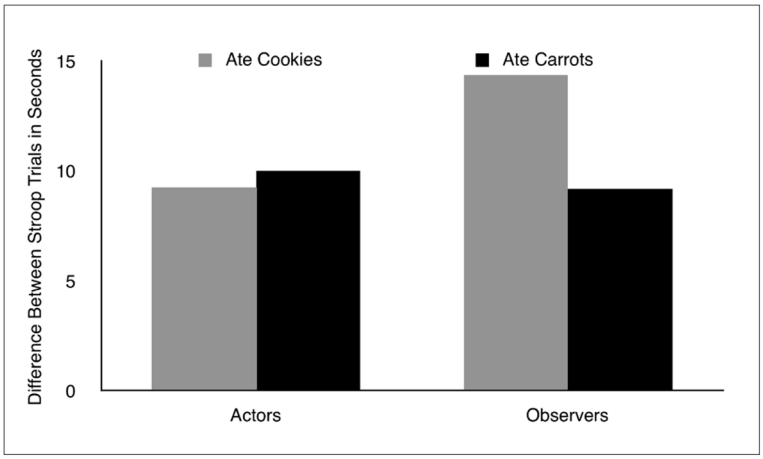

Figure 1.
Change in the number of seconds taken to complete the incongruent and congruent trials on the Stroop task in Study 2 by role and self-control condition

Table 1

Regulatory Exertion on the Handgrip Task in Study 1 by Time and Condition

	Good self-control		Bad self-control	
	M	***SD***	***M***	***SD***
First grip	37.33	41.89	44.39	46.42
Second grip	44.83	34.78	27.72	30.32

Table 2

Regulatory Exertion on the Remote Associates Test (RAT) Task in Study 5

	Good self-control		Bad self-control		Moderate extraversion	
	M	***SD***	***M***	***SD***	***M***	***SD***
Persistence	8.07	5.19	5.45	3.99	6.80	3.97
Performance	3.85	2.38	2.79	1.86	3.38	1.99
RAT Index	0.28	0.95	−0.28	0.72	0.01	0.75

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Table 3

Means (in Log-Transformed Milliseconds) and Standard Deviations by Condition and Target in Study 5

	Good self-control		Bad self-control		Moderately extraverted	
	M	*SD*	*M*	*SD*	*M*	*SD*
Positive self-control words	644.87	99.28	714.25	155.77	733.45	127.07
Negative self-control words	664.85	102.27	725.77	205.74	748.50	137.54