Journal of Experimental Psychology:
Learning, Memory, and Cognition
2010, Vol. 36, No. 5, 1314–1320

0278-7393/10/$12.00 DOI: 10.1037/a0020120

Imagined Positive Emotions and Inhibitory Control: The Differentiated Effect of Pride Versus Happiness

Maayan Katzir, Tal Eyal, Nachshon Meiran, and Yoav Kessler
Ben-Gurion University of the Negev

Inhibitory control is a cognitive mechanism that contributes to successful self-control (i.e., adherence to a long-term goal in the face of an interfering short-term goal). This research explored the effect of imagined positive emotional events on inhibition. The authors proposed that the influence of imagined emotions on inhibition depends on whether the considered emotion corresponds to the attainment of a long-term goal (i.e., pride) or a short-term goal (i.e., happiness). The authors predicted that in an antisaccade task that requires inhibition of a distractor, imagining a happiness-eliciting event is likely to harm inhibitory processes compared with imagining a pride-eliciting event, because the former but not the latter primes interfering short-term goals. The results showed that imagining a happiness-eliciting event decreased inhibition relative to imagining a pride-eliciting event. The results suggest a possible mechanism underlying the role of imagined positive emotions in pursuit of goals that require self-control.

Keywords: imagined emotions, self-control, inhibitory control, prepotent response, positive emotions

Because both executive control and emotions are central to self-regulatory processes, understanding how emotions influence executive functions is important. Research exploring the nature of this impact has focused mainly on valence (positive vs. negative affect) as the primary dimension of investigation (e.g., Ashby, Isen, & Turken, 1999; Dreisbach & Goschke, 2004; Kuhl & Kazén, 1999; Oaksford, Morris, Grainger, & Williams, 1996; Phillips, Bull, Adams, & Fraser, 2002). However, the inconclusive results regarding positive emotions do not clarify whether such emotions are beneficial or detrimental to executive control (Mitchell & Phillips, 2007). We suggest that in order to gain a better understanding of how emotions affect executive functions, one should consider the motivational role of distinct emotions.

In the current research, we examined how the consideration of positive emotional events influences inhibition, a primary executive function. We suggest that associations between distinct positive emotions (pride vs. happiness) and different goals (long term vs. short term) modulate this influence. Specifically, we argue that the attainment of long-term goals depends on one's ability to suspend short-term goals and that the suspension of short-term goals depends on the executive system, especially its inhibitory aspects. Moreover, attaining long-term goals is linked to the experience of pride and self-worth, whereas attainment of immediate goals is linked to the experience of happiness and joy. Therefore, we predict that imagining a future experience of happiness, which presumably primes short-term goals, would decrease inhibitory control compared with imagining a future experience of pride, which presumably primes long-term goals. We base our proposition on the relationship between executive functions and self-control (Barkley, 2001; Miller & Cohen, 2001; Muraven & Baumeister, 2000) as well as on recent evidence regarding the differential influence of emotions on self-control success (Eyal & Fishbach, 2010).

Executive Functions and Self-Control

Self-control conflicts arise when people face a choice between a long-term goal that offers large yet delayed benefits and a short-term goal (i.e., a desire or temptation) that offers smaller yet immediate benefits (Baumeister, Heatherton, & Tice, 1994; Kuhl & Beckmann, 1985; Loewenstein, 1996; Metcalfe & Mischel, 1999; Trope & Fishbach, 2000). To resolve a self-control conflict in favor of the long-term goal, one must recruit cognitive functions that suppress immediate temptations, maintain an active representation of the long-term goal, and shield goals from interference. The cognitive mechanisms that enable adherence to long-term goals have been discussed in the literature as *ego resources* (Muraven & Baumeister, 2000) or *executive functions* (e.g., Barkley, 2001; Miller & Cohen, 2001).

According to current theorizing, executive functions facilitate adherence to long-term goals through (a) inhibiting prepotent short-term desires (e.g., Barkley, 2001; Muraven & Baumeister, 2000), (b) holding a goal and goal-related information in working memory (e.g., De Jong, Berendsen, & Cools, 1999; Duncan, Emslie, Williams, Johnson, & Freer, 1996; Kane et al., 2007), (c) shielding goals from interference (e.g., Goschke & Dreisbach, 2008; Kessler & Meiran, 2008), and (d) switching flexibly between goals (e.g., Meiran, 2010).

Support for the relation between executive functions and self-control comes from research showing activation in brain regions associated with executive functions when exerting self-control, mostly the prefrontal cortex (e.g., Luria, 1966; Miller & Cohen,

Maayan Katzir, Tal Eyal, Nachshon Meiran, and Yoav Kessler, Department of Psychology, Ben-Gurion University of the Negev, Beer Sheva, Israel.

Correspondence concerning this article should be addressed to Maayan Katzir, Department of Psychology, Ben-Gurion University of the Negev, Beer-Sheva 84105, Israel. E-mail: katzirma@bgu.ac.il

2001). For example, a recent study showed that delay of gratification (choosing the delayed yet larger reward over the immediate yet smaller reward) was correlated with increased activation in the lateral prefrontal cortex and posterior parietal cortex. In contrast, submitting to temptation (i.e., choosing the immediate smaller reward) was mediated by the limbic system (McClure, Laibson, Loewenstein, & Cohen, 2004).

Many executive function tasks involve inhibitory control. For example, the antisaccade task requires overcoming the tendency to gaze at a distractor in a different location (e.g., Friedman & Miyake, 2004; Roberts, Hager, & Heron, 1994). In one version of this task, participants begin a trial by viewing a central fixation point on a computer screen. A distractor then appears on one side of the screen (i.e., left or right). Participants are instructed not to look at the distractor but to move their eyes in the opposite direction (i.e., right or left, respectively) toward a target stimulus. This target stimulus is an arrow pointing at a specific direction (up, left, or right). Participants are instructed to respond to the direction of the arrow (Miyake et al., 2000). Thus, for successful task performance, the participant must inhibit his or her automatic response (i.e., saccade toward the distractor) and execute a saccade in the opposite direction, which requires control (Nigg, 2000).

Emotions and Self-Control

Recent research on the role of emotions in self-control shows that specific emotions such as pride, guilt, and shame are associated with adherence to long-term goals. Conversely, emotions such as happiness and sadness are associated with pursuit of short-term goals (Eyal & Fishbach, 2010; Williams & DeSteno, 2008; Zemack-Rugar, Bettman, & Fitzsimons, 2007). For example, Williams and DeSteno (2008) found that experiencing pride (but not general positive mood) increased participants' perseverance in a tedious task described as measuring a desirable ability.

Past research has focused primarily on how emotional experience influences goal pursuit; however, it has been suggested recently that emotions may also have a motivational function without being actually experienced (Baumeister, Vohs, DeWall, & Zhang, 2007; Damasio, 1994; Eyal & Fishbach, 2010). Specifically, this research suggests that because emotions become associated with specific activities and goals, merely thinking about a future emotional experience primes actions and goals that are associated with the specific emotional experience. Therefore, when emotions are considered, either by exposing participants to emotion terms (e.g., the word *happy*) or by asking participants to imagine a future experience that would evoke a specific emotion, people are motivated to act in ways that would evoke the desirable feeling.

For example, Eyal and Fishbach (2010) found that certain emotions (e.g., pride, self-worth) are implicitly associated with long-term goals, whereas other emotions (e.g., happiness, fun) are implicitly associated with short-term goals. Therefore, exposing participants to words related to happiness or asking participants to write about a future event that is likely to evoke these emotions led participants to exercise less self-control (e.g., by persisting less on a difficult task or eating more chocolate) than exposing participants to words and events related to pride. Research also suggests that considering emotional words and events does not elicit the emotional experience but rather acts as goal priming by increasing the motivation to adhere to the activity that would result in the corresponding experience (Eyal & Fishbach, 2010; see also Zemack-Rugar et al., 2007, for a related process with negative emotions). In other words, imagining positive emotional events influences self-control by creating anticipation of experiencing the emotion that corresponds to the long- versus short-term goal.

In the current research, we predicted that imagining a future event that is likely to evoke positive emotions influences not only the pursuit of long- versus short-term goals but also the operation of executive functions. We suggest that this occurs because the attainment of long-term goals requires deferring interfering short-term goals, and deferring short-term goals occurs through the cognitive mechanisms of inhibition, among other executive functions. Therefore, we predicted that imagining emotional events that relate to the achievement of short-term goals (e.g., happiness) would decrease inhibition compared with imagined events that relate to long-term goals (e.g., pride). Two experiments tested this prediction by having participants imagine a future event that is likely to evoke pride versus happiness and then perform the antisaccade task (Hallett, 1978; Miyake et al., 2000) as a measure of inhibition.

Experiment 1

In this experiment, we tested the hypothesis that imagining a happiness-eliciting event is likely to impair inhibitory functions compared with imagining a pride-eliciting event. To manipulate the imagining of emotional events, we first asked participants to write about a future experience they expected to evoke feelings of happiness and fun (vs. pride and self-worth), and they were exposed to pictures of individuals expressing the corresponding emotions. In the second stage of the experiment, participants performed the antisaccade task, which involves inhibition of a prepotent response (i.e., gaze at an interfering distractor; Hallett, 1978; Miyake et al., 2000). In this task, participants are required to shift their gaze away from a distractor that precedes a target stimulus by overcoming the strong tendency to gaze at the distractor. To increase inhibitory challenge, we enlisted young male adults as participants and used pictures of female models in bathing suits as distractors.

We reasoned that the attainment of long-term goals depends on successful operation of the executive system. Because imagining pride primes long-term goals, and imagining happiness primes short-term goals, we expected that imagining a future event that likely evokes happiness would impair inhibitory functioning compared with imagining a future event that likely evokes pride. As a result, participants who imagined a happiness-eliciting event would perform less well on the antisaccade task than those who imagined a pride-eliciting event. We also included a control condition in which participants considered an emotionally neutral event.

Method

Participants. Thirty-six Ben-Gurion University male undergraduates, 22 to 30 years old, participated in the experiment. We prescreened those who indicated they might be offended by certain pictures. All participants were right-handed native Hebrew speakers who participated in the experiment in return for 20 shekels (~$6.00).

Materials and procedure. Participants completed the experiment, ostensibly about attention, on desktop computers in individual sessions. They read that the experiment comprised several unrelated parts. First, we manipulated imagined emotion. Participants read that the researchers were currently developing a questionnaire that would provide a systematic understanding of what influences people's emotions. The participants' task was to describe an event that would make them feel pride and self-worth (pride condition) or happiness and fun (happiness condition) if it happened in the near future. Participants in the imagined-pride condition ($n = 13$) listed events such as receiving good grades on school assignments, winning in a sporting event, or being acknowledged by a boss or a family member. Participants in the imagined-happiness condition ($n = 11$) listed events such as parties and vacations, and spending time with a friend or family member. Participants in the control group ($n = 12$) described how their room would look in the near future.[1] To strengthen the emotion manipulation, we exposed participants to four pictures of individuals (three male and one female) with proud (vs. happy) expressions, presented from the waist up. In the control group, we exposed participants to pictures of individuals with neutral expressions (Tracy, Robins, & Schriber, 2009). To mask the true purpose of the second task, we asked participants to rate each picture on brightness and sharpness, dimensions irrelevant to the manipulation (7-point scale: -3 = *not sharp/not bright*, 3 = *sharp/bright*).

Note that we manipulated the imagination of a future emotional event and not an emotional experience. A pretest confirmed this distinction. Seventy-five participants performed the imagined emotion manipulation and then rated the intensity of their emotional feeling (pride/happiness) on 9-point scales (1 = *extremely low intensity*, 9 = *extremely high intensity*) in counterbalanced order. Analysis of variance (ANOVA) of Imagined Emotion (pride vs. happiness vs. neutral) $\times$ Felt Emotion (pride vs. happiness) on intensity did not yield a significant main effect for imagined emotion, $F(1, 72) = 1.25$, $p = .29$, $\eta_p^2 = .03$; or a significant main effect for felt emotion, $F(1, 72) = 1.55$, $p = .22$, $\eta_p^2 = .02$; or a significant Imagined Emotion $\times$ Felt Emotion interaction, $F(1, 72) = 1.75$, $p = .18$, $\eta_p^2 = .05$. Specifically, participants who imagined a pride-eliciting event ($M = 5.72$, $SD = 2.05$) did not report feeling more intense pride than participants who imagined a happiness-eliciting event ($M = 5.12$, $SD = 2.23$), $F(1, 72) = 1.22$, $p = .27$, $\eta_p^2 = .02$, or than participants who imagined a neutral event ($M = 5.71$, $SD = 1.45$), $F < 1$. In addition, participants who imagined a happiness-eliciting event ($M = 5.23$, $SD = 1.96$) did not report more intense happiness than participants who imagined a pride-eliciting event ($M = 5.60$, $SD = 2.17$), $F < 1$. However, participants who imagined a happiness-eliciting event reported feeling marginally less happiness than participants who imagined a neutral event ($M = 6.29$, $SD = 1.85$), $F(1, 72) = 3.49$, $p = .07$, $\eta_p^2 = .05$. These results confirm our expectation that our manipulation did not induce a distinct emotional experience or did so negligibly.

The second part of the experiment measured inhibition success in an adapted version of a computerized antisaccade task (Miyake et al., 2000). In this task, participants' assignment was to indicate the direction at which an arrow is pointing (left, up, right, or down). The arrow was presented on one side of the screen (i.e., left or right) and was always preceded by a distractor, which appeared on the opposite side of the screen (i.e., right or left, respectively). We ran the 48-trial task on IBM computers with a 17-in monitor. In each trial, a fixation point (+) was first presented in the middle of the screen for a variable amount of time (between 1,500 ms and 3,500 ms in increments of 250 ms). A visual distractor (a 6.5 cm $\times$ 10.0 cm picture) was then presented on the right or left side of the fixation point for a variable amount of time (stimulus onset asynchrony [SOA]: 200, 300, 400, or 500 ms), followed by a target stimulus that appeared for 166 ms before being masked by a black square. The difficulty of the task was increased by having the distractors not disappear when the target appeared (resulting in an additional 166 ms of distractor presentation on each SOA condition). In each trial, the distractor and target were presented on opposite sides of the fixation point with their center located 10.75 cm away from the fixation point (see Figure 1).

Distractors were 24 pictures (6.0 cm $\times$ 8.5 cm) of female models in bathing suits. We presented each picture twice in randomized order across participants. The target stimulus consisted of a black arrow (6 mm $\times$ 8 mm) inside a white square (2.5 cm $\times$ 2.5 cm). Participants indicated the direction of the arrow (left, up, right, or down) by pressing the corresponding arrow key on the keyboard.

Because the arrow appeared for only 166 ms before being masked, participants had to inhibit the automatic response of looking at the preceding distracting pictures in order to correctly identify the direction of the arrow. Thus, the proportion of correct responses served as the dependent measure (Miyake et al., 2000).

Design. We used an imagined emotion (happiness, pride, neutral) between-subjects design. Proportion of correct responses served as the dependent measure.

Results and Discussion

An ANOVA of imagined emotion on the proportion of correct responses yielded the predicted main effect for imagined emotion, $F(1, 33) = 4.50$, $p = .02$, $\eta_p^2 = .21$.[2] A planned comparison using the pooled error term indicated a smaller proportion of correct responses in the imagined-happiness condition ($M = .82$, $SD = .10$) than in the imagined-pride condition ($M = .89$, $SD = .07$), $F(1, 33) = 4.02$, $p = .05$, $\eta_p^2 = .11$. In addition, the proportion of correct responses was smaller in the imagined-happiness condition than in the neutral condition ($M = .92$, $SD = .08$), $F(1, 33) = 8.74$, $p = .006$, $\eta_p^2 = .21$. Finally, there was no difference in the proportion of correct responses in the imagined-pride condition

[1] Two independent judges read all participants' descriptions. Participants who, according to both judges, failed to follow instructions, either because they described a future pride event in the imagined happiness condition and vice versa or because they described a past instead of a future experience, were removed from all analyses (two in Experiment 1 and four in Experiment 2).

[2] There was no interaction between SOA and imagined emotion in this experiment, therefore the SOA variable was not entered into the analyses and is not further discussed. Note that entering the SOA variable into the analyses did not alter the pattern of results reported.

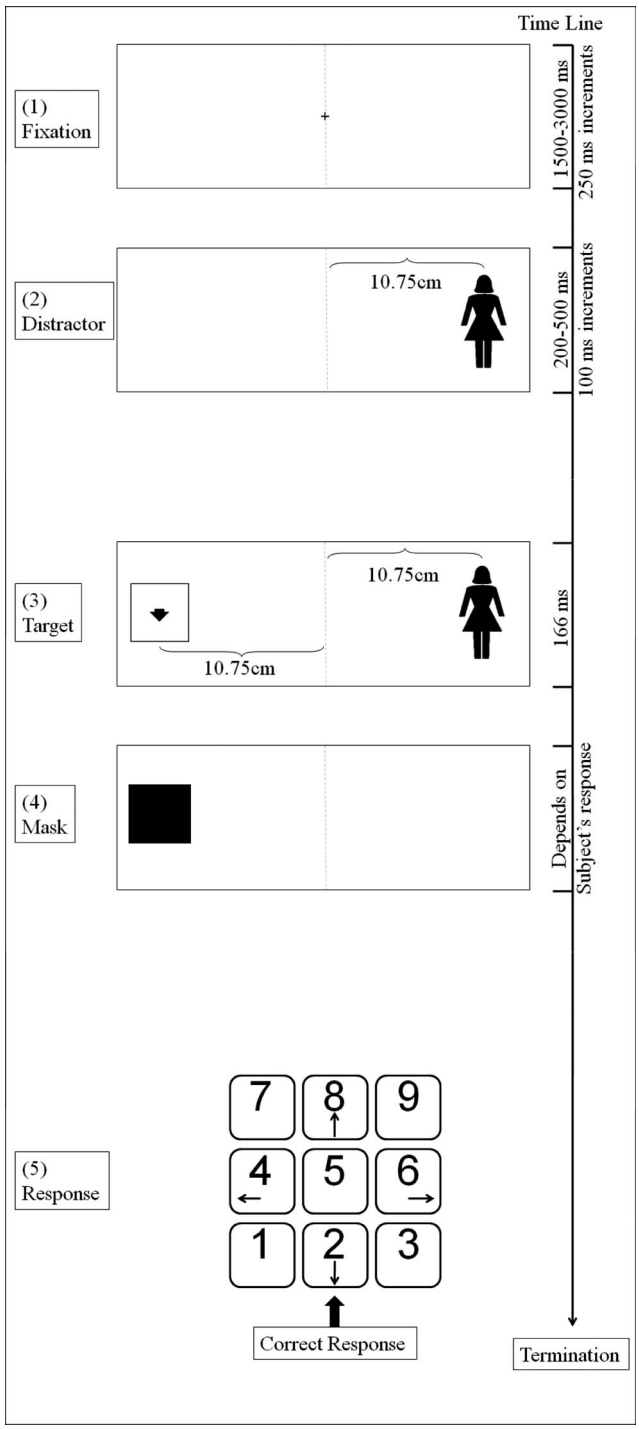

Figure 1. Illustration of a trial in the antisaccade task. Fixation point was first presented in the middle of the screen (1). The visual distractor was then presented on one of its sides (2), followed by a target stimulus on the other side (3). Then the distractor disappeared, and a black square masked the target (4). The next trial began immediately after the participant responded (5).

and the neutral condition, $F(1, 33) = 1.06$, $p = .31$, $\eta_p^2 = .03$ (see Figure 2).[3]

As predicted, the consideration of a happiness-eliciting event decreased inhibition compared with the consideration of a pride-eliciting event and a control condition. Presumably, this is because imagining a happy event primes short-term goals that interfere with inhibition control. However, contrary to our prediction, the consideration of a pride-eliciting event did not increase inhibition compared with the control condition. We discuss possible reasons for the obtained asymmetry in the effect of imagined pride and happiness in the General Discussion section.

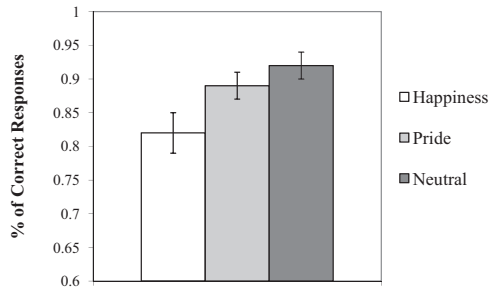

Figure 2. Proportion of correct responses as a function of imagined emotion. Error bars represent standard errors.

Another limitation of Experiment 1 is that our use of pictures of models in bathing suits as distractors might have led participants in the imagined-happiness condition to gaze longer at happiness-eliciting pictures, thereby resulting in poorer performance than that of those in the imagined-pride condition. Accordingly, in Experiment 2, we manipulated the content of the distractor by using pictures related to happiness (i.e., models in bathing suits) versus pictures related to pride (i.e., national and achievement symbols).

Experiment 2

We ran Experiment 2 to rule out the possibility that imagined happiness (vs. pride) increased the tendency to gaze longer at pictures related to happiness rather than decreasing the inhibition of any distractors. Half of the participants performed the antisaccade task with pictures of models in bathing suits as distractors (pictures related to happiness and pleasure), whereas the other half performed the same task with pictures of national and achievement symbols as distractors (pictures related to pride). We reasoned that if the alternative explanation is true and imagining an emotional event increases the tendency to gaze longer at distractors with related emotional content, presenting pride-related pictures as distractors would reverse the effect seen in Experiment 1. That is, performing the antisaccade task with pride-related distractors would impair performance in the imagined-pride condition compared with the imagined-happiness condition. However, because we believe that imagined happiness influences behavior by priming short-term goals, we expected a

[3] An ANOVA of imagined emotion (pride vs. happiness vs. neutral) on reaction time (RT) yielded a null effect ($F < 1$), indicating there was no difference in RT between the imagined-happiness ($M = 488$, $SD = 120$), imagined-pride ($M = 469$, $SD = 74$), and control ($M = 466$, $SD = 112$) conditions. This indicates that the reported imagined-emotion effect was not a result of speed–accuracy trade-off. All additional RT analyses in this experiment yielded null effects and are thus not further discussed. Note that before performing the antisaccade task, participants were instructed to respond accurately and were not instructed to respond quickly.

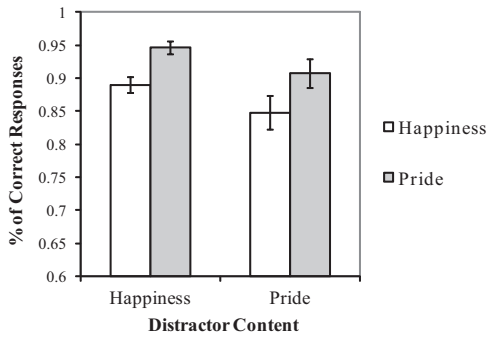

Figure 3. Proportion of correct responses as a function of imagined emotion and distractor. Error bars represent standard errors.

decrease in inhibition of participants who imagined a happiness-eliciting event regardless of the distractor content. Thus, we did not expect the effect reported in Experiment 1 to interact with the distractor condition.[4]

Method

Participants. Forty-six Ben-Gurion University male undergraduates, 18 to 33 years old, who met the same criteria as participants in Experiment 1, participated in the experiment.

Materials and procedure. The procedure differed from Experiment 1 in only two respects. First, there was no control condition. Second, in the antisaccade task, the 24 pictures of female models served as distractors for only half of the participants. We presented the other half with 24 pride-related pictures (6 cm × 6 cm) of the Israeli flag, medals, and graduation symbols (adapted from Oveis et al., 2009).

Design. We used a 2 (imagined emotion: happiness, pride) × 2 (distractor: happiness related, pride related) design. Imagined emotion and distractor were between-participants variables, resulting in four experimental conditions: imagined-pride/pride-distractors (n = 11), imagined-happiness/pride-distractors (n = 10), imagined-pride/happiness-distractors (n = 12), and imagined-happiness/happiness-distractors (n = 13). Proportion of correct responses served as the dependent measure.

Results and Discussion

An ANOVA of Imagined Emotion × Distractor on the proportion of correct responses yielded an unexpected main effect for the distractor, $F(1, 42) = 5.05$, $p = .03$, $\eta_p^2 = .12$, indicating that the proportion of correct responses was higher for happiness-related distractors ($M = .92$, $SD = .05$) than for pride-related distractors ($M = .88$, $SD = .08$). More important, we replicated the results of Experiment 1 with the predicted main effect for imagined emotion, $F(1, 42) = 10.20$, $p = .002$, $\eta_p^2 = .20$, indicating that the proportion of correct responses was smaller in the imagined-happiness condition ($M = .87$, $SD = .07$) than in the imagined-pride condition ($M = .93$, $SD = .06$).[5] In addition, the Imagined Emotion × Distractor interaction did not approach significance ($F < 1$), indicating that the effect of imagined emotion on inhibition was independent of distractor content (see Figure 3). This finding rules out the alternative explanation according to which imagined happiness increases the tendency to gaze at pleasurable pictures rather than impairing inhibition.

General Discussion

This research used a modified antisaccade task to test the influence of imagining positive emotional events on inhibitory control, which enables the adherence to long-term goals in the face of interference. We found that imagining a happiness-eliciting event decreased inhibition relative to imagining a pride-eliciting event. However, whereas imagined happiness decreased inhibition compared with a control group, imagined pride did not boost inhibition compared with a control group. In addition, we obtained the different effect of pride versus happiness on inhibition regardless of whether the distractor had happiness- or pride-related content, indicating that imagined happiness (vs. pride) does not increase the tendency to be distracted by pleasurable pictures only. Rather, it increases the tendency to be distracted by any interfering stimuli, regardless of the content. These results suggest that imagining events that elicit positive emotions (happiness vs. pride) differentially affect inhibition, a mechanism enabling self-control.

Prior research on the relation between affect and executive functions has focused mainly on the valence of affective *experience*, comparing positive and negative feelings. This line of research resulted in inconclusive evidence (for a review, see Mitchell & Phillips, 2007). The current research suggests a new approach that emphasizes the motivational role of *imagined* emotion and its relation to goals. Specifically, we propose that because certain emotions (e.g., pride) are linked to long-term goals and other emotions (e.g., happiness) are linked to short-term goals, imagining future events that are likely to elicit different emotions leads to the pursuit of the corresponding (long- vs. short-term) goal. As such, when emotions are imagined, without actually being experienced, they act as motivation primes: They increase the motivation to adhere to an activity that will result in the experience of the particular positive emotion (Baumeister et al., 2007; Eyal & Fishbach, 2010). Support for the notion that imagined emotions have a

[4] A pilot study confirmed that the two sets of pictures were distinctly related to different emotional content. Participants saw both sets of pictures separately and indicated the extent to which each set was related to feelings of happiness versus pride. A Distractor Content (happiness vs. pride related) × Related Emotional Content (happiness vs. pride) ANOVA yielded a significant interaction, $F(1, 11) = 23.12$, $p < .0001$, $\eta_p^2 = .68$, indicating that pictures of models ($M = 7.75$, $SD = 1.54$) were related to happiness more than pictures of achievement and national symbols ($M = 6.33$, $SD = 1.70$), $F(1, 11) = 4.82$, $p = .05$, $\eta_p^2 = .30$. In addition, pictures of achievement and national symbols ($M = 7.92$, $SD = 0.90$) were related to pride more than pictures of models in bathing suits ($M = 5.25$, $SD = 2.18$), $F(1, 11) = 14.98$, $p = .003$, $\eta_p^2 = .58$.

[5] An ANOVA of Imagined Emotion × Distractor on RT yielded no main effects or Imagined Emotion × Distractor interaction, Fs < 1. Thus, there was no difference in RT between the imagined-pride condition ($M = 454$, $SD = 48$) and imagined-happiness condition ($M = 407$, $SD = 34$) when the task included pride-related distractors, $F < 1$. Similarly, there was no difference in RT between the imagined-pride condition ($M = 428$, $SD = 46$) and imagined-happiness condition ($M = 429$, $SD = 36$) when the task included happiness-related distractors, $F < 1$. This indicates that the reported imagined-emotion effect was not a result of speed–accuracy trade-off.

unique motivational role also comes from research on self-control (Eyal & Fishbach, 2010; Williams & DeSteno, 2008).

The results of Experiment 1 indicate that, as predicted, imagined happiness impaired inhibition functioning. According to our theorizing, imagined happiness activates interfering short-term goals, consequently decreasing performance in an antisaccade task. Contrary to our prediction, imagined pride had no effect on inhibition compared with a neutral condition. This pattern of results might indicate that some imagined emotions (e.g., happiness) influence inhibition, whereas other imagined emotions (e.g., pride) do not. Yet, it is possible that the results reflect the nature of our imagined-emotion manipulation. Specifically, it might be that in the academic setting in which our study was conducted, pride and long-term goals are continuously activated (see Oveis et al., 2009), thus making the "neutral" condition not completely neutral, but rather more similar to the imagined-pride group.

In this article we have adopted the common view of the antisaccade task as a measure of inhibition (e.g., Friedman & Miyake, 2004; Nigg, 2000). However, some researchers have argued that this task also involves working memory. For example, according to Roberts et al. (1994), performance in the antisaccade task depends on the interaction between inhibition and working memory, such that working-memory load impairs task performance. In a similar vein, Nieuwenhuis, Broerse, Nielen, and De Jong (2004) suggested that inadequate performance on the task indicates a neglect of the goal to antisaccade. This interpretation is in line with the notion that holding goals in working memory is crucial for successful inhibition (De Jong et al., 1999). Thus, we are unable to determine which of the two are influenced by imagined emotions. However, as both inhibition and working memory facilitate self-control, the merit of our findings remains. That is, the current findings demonstrate that in a task that highlights the need to suppress a tempting distractor, imagined happiness compared with imagined pride decreased the operation of cognitive functions underlying successful self-control.

The current research focuses on inhibition of distracting information, which is but a single process through which one may achieve successful self-control (e.g., Barkley, 2001; Miller & Cohen, 2001). Other research has proposed that self-control processes involve other executive functions (e.g., De Jong et al., 1999; Duncan et al., 1996; Goschke & Dreisbach, 2008; Kessler & Meiran, 2008; Meiran, 2010), including different types of inhibition. On the basis of the link between executive functions and self-control, our work suggests that the type of emotion being imagined (i.e., whether related to a short-term goal or a long-term goal) might be a useful factor in understanding the impact of positive emotions on other executive functions.

Our current research focused on imagined positive emotions; however, a related question concerns the influence of imagined negative emotions on inhibition and other executive mechanisms. Although imagined positive emotions influence control by priming the pursuit of a goal in order to attain a desirable end state, imagined negative emotions might influence control by priming the pursuit of a goal in order to avoid an undesirable end state (e.g., Baumeister et al., 2007; Eyal & Fishbach, 2010). Thus, we predict that imagined negative emotions that correspond to failure in attaining long-term goals (e.g., shame and guilt) will improve executive control compared with imagined negative emotions that correspond to failure in attaining short-term goals (e.g., sadness and anger).

References

Ashby, F. G., Isen, A. M., & Turken, A. U. (1999). A neuropsychological theory of positive affect and its influence on cognition. *Psychological Review, 106,* 529–550. doi:10.1037/0033-295X.106.3.529

Barkley, R. A. (2001). The executive functions and self-regulation: An evolutionary neuropsychological perspective. *Neuropsychology Review, 11,* 1–29. doi:10.1023/A:1009085417776

Baumeister, R. F., Heatherton, T. F., & Tice, D. M. (1994). *Losing control: How and why people fail at self-regulation.* San Diego, CA: Academic Press.

Baumeister, R. F., Vohs, K. D., DeWall, C. N., & Zhang, L. (2007). How emotion shapes behavior: Feedback, anticipation, and reflection, rather than direct causation. *Personality and Social Psychology Review, 11,* 167–203. doi:10.1177/1088868307301033

Damasio, A. R. (1994). *Descartes' error: Emotion, reason, and the human brain.* New York, NY: Grosset/Putnam.

De Jong, R., Berendsen, E., & Cools, R. (1999). Goal neglect and inhibitory limitations: Dissociable causes of interference effects in conflict situations. *Acta Psychologica, 101,* 379–394. doi:10.1016/S0001-6918(99)00012-8

Dreisbach, G., & Goschke, T. (2004). How positive affect modulates cognitive control: Reduced perseveration at the cost of increased distractibility. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 30,* 343–353. doi:10.1037/0278-7393.30.2.343

Duncan, J., Emslie, H., Williams, P., Johnson, R., & Freer, C. (1996). Intelligence and the frontal lobe: The organization of goal-directed behavior. *Cognitive Psychology, 30,* 257–303. doi:10.1006/cogp.1996.0008

Eyal, T., & Fishbach, A. (2010). *The motivation-emotion matching hypothesis.* Unpublished manuscript, Ben-Gurion University of the Negev.

Friedman, N. P., & Miyake, A. (2004). The relations among inhibition and interference control functions: A latent-variable analysis. *Journal of Experimental Psychology: General, 133,* 101–135. doi:10.1037/0096-3445.133.1.101

Goschke, T., & Dreisbach, G. (2008). Conflict-triggered goal shielding: Response conflicts attenuate background monitoring for prospective memory cues. *Psychological Science, 19,* 25–32. doi:10.1111/j.1467-9280.2008.02042.x

Hallett, P. E. (1978). Primary and secondary saccades to goals defined by instructions. *Vision Research, 18,* 1279–1296. doi:10.1016/0042-6989(78)90218-3

Kane, M. J., Brown, L. H., McVay, J. C., Silvia, P. J., Myin-Germeys, I., & Kwapil, T. R. (2007). For whom the mind wanders, and when: An experience-sampling study of working memory and executive control in daily life. *Psychological Science, 18,* 614–621. doi:10.1111/j.1467-9280.2007.01948.x

Kessler, Y., & Meiran, N. (2008). Two dissociable updating processes in working memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 34,* 1339–1348. doi:10.1037/a0013078

Kuhl, J., & Beckmann, J. (1985). *Action control from cognition to behavior.* New York, NY: Springer-Verlag.

Kuhl, J., & Kazén, M. (1999). Volitional facilitation of difficult intentions: Joint activation of intention memory and positive affect removes Stroop interference. *Journal of Experimental Psychology: General, 128,* 382–399. doi:10.1037/0096-3445.128.3.382

Loewenstein, G. (1996). Out of control: Visceral influences on behavior. *Organizational Behavior and Human Decision Processes, 65,* 272–292. doi:10.1006/obhd.1996.0028

Luria, A. R. (1966). *Human brain and psychological processes.* New York, NY: Harper & Row.

McClure, S. M., Laibson, D. I., Loewenstein, G., & Cohen, J. D. (2004, October 15). Separate neural systems value immediate and delayed monetary rewards. *Science, 306,* 503–507. doi:10.1126/science.1100907

Meiran, N. (2010). Task switching: Mechanisms underlying rigid vs. flexible self-control. In R. R. Hassin, K. N. Ochsner, & Y. Trope (Eds.), *Self control in society, mind, and brain* (pp. 202–220). New York, NY: Oxford University Press.

Metcalfe, J., & Mischel, W. (1999). A hot/cool-system analysis of delay of gratification: Dynamics of willpower. *Psychological Review, 106,* 3–19. doi:10.1037/0033-295X.106.1.3

Miller, E. K., & Cohen, J. D. (2001). An integrative theory of prefrontal cortex function. *Annual Reviews of Neuroscience, 24,* 167–202. doi:10.1146/annurev.neuro.24.1.167

Mitchell, R. L. C., & Phillips, L. H. (2007). The psychological, neurochemical and functional neuroanatomical mediators of the effects of positive and negative mood on executive functions. *Neuropsychologia, 45,* 617–629. doi:10.1016/j.neuropsychologia.2006.06.030

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology, 41,* 49–100. doi:10.1006/cogp.1999.0734

Muraven, M., & Baumeister, R. F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin, 126,* 247–259. doi:10.1037/0033-2909.126.2.247

Nieuwenhuis, S., Broerse, A., Nielen, M. M. A., & De Jong, R. (2004). A goal activation approach to the study of executive function: An application to antisaccade tasks. *Brain and Cognition, 56,* 198–214. doi:10.1016/j.bandc.2003.12.002

Nigg, J. T. (2000). On inhibition/disinhibition in developmental psychopathology: Views from cognitive and personality psychology and a working inhibition taxonomy. *Psychological Bulletin, 126,* 220–246. doi:10.1037/0033-2909.126.2.220

Oaksford, M., Morris, F., Grainger, B., & Williams, J. M. G. (1996). Mood, reasoning, and central executive processes. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 22,* 476–492. doi:10.1037/0278-7393.22.2.476

Oveis, C., Cohen, A. B., Gruber, J., Shiota, M. N., Haidt, J., & Keltner, D. (2009). Resting respiratory sinus arrhythmia is associated with tonic positive emotionality. *Emotion, 9,* 265–270. doi:10.1037/a0015383

Phillips, L. H., Bull, R., Adams, E., & Fraser, L. (2002). Positive mood and executive function: Evidence from Stroop and fluency tasks. *Emotion, 2,* 12–22. doi:10.1037/1528-3542.2.1.12

Roberts, R. J., Hager, L. D., & Heron, C. (1994). Prefrontal cognitive processes: Working memory and inhibition in the antisaccade task. *Journal of Experimental Psychology: General, 123,* 374–393. doi:10.1037/0096-3445.123.4.374

Tracy, J. L., Robins, R. W., & Schriber, R. A. (2009). Development of a FACS-verified set of basic and self-conscious emotion expressions. *Emotion, 9,* 554–559. doi:10.1037/a0015766

Trope, Y., & Fishbach, A. (2000). Counteractive self-control in overcoming temptation. *Journal of Personality and Social Psychology, 79,* 493–506. doi:10.1037/0022-3514.79.4.493

Williams, L. A., & DeSteno, D. (2008). Pride and perseverance: The motivational role of pride. *Journal of Personality and Social Psychology, 94,* 1007–1017. doi:10.1037/0022-3514.94.6.1007

Zemack-Rugar, Y., Bettman, J. R., & Fitzsimons, G. J. (2007). The effects of nonconsciously priming emotion concepts on behavior. *Journal of Personality and Social Psychology, 93,* 927–939. doi:10.1037/0022-3514.93.6.927

Received May 5, 2009
Revision received March 11, 2010
Accepted March 22, 2010 ■