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Priming and Authorship Ascription: When Nonconscious Goals Turn Into Conscious Experiences of Self-Agency

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The conscious experience of self-agency (i.e., the feeling that one causes one's own actions and their outcomes) is fundamental to human self-perception. Four experiments explored how experienced self-agency arises from a match between nonconsciously activated outcome representations and the subsequent production of the outcome and explored specifically how implicit motivation to produce the outcome may impinge on this process. Participants stopped a rapidly presented sequence of colors on a computer screen. Subsequently, they were presented with what could be the color on which they had stopped the sequence or a color that was randomly chosen by the computer. Agency ratings after each trial revealed that priming outcomes (a specific color) just before the outcome was produced enhanced experienced self-agency. Importantly, priming outcomes relatively far in advance also augmented self-agency, but only if the outcome was attached to positive affect and thus operating as a nonconscious goal maintaining the outcome representation active over time. As such, these studies show how the mechanisms underlying nonconscious goal pursuit promote experiences of self-agency, thus integrating 2 lines of research that so far have led separate lives.

Keywords: self-agency, conscious experiences, nonconscious goals, priming

> There appears to be no support for the folk psychology notion that the act follows the will, in the sense that physical action is caused by mental events that precede them. (Prinz, 2003, p. 26)

The ability to become aware of one's own actions and their consequences is a uniquely human trait. It enables people to distinguish between the outcomes that result from the actions of others and outcomes that are produced by oneself and to attribute them to the proper agent. The ascription of personal authorship constitutes a fundamental aspect of our society in general and our legal system in particular. Furthermore, experiences of self-agency (i.e., the feeling that one causes one's own actions and their outcomes) have an intimate relationship with self-awareness and may be the source of the general belief that people's behavior is governed by consciousness or some other type of inner agent such as the will or the self. Consciousness, it is argued, animates mental processes relevant to self-regulation and control, such as setting and maintaining goals to attain desired outcomes. Thus, experiences of self-agency are the obvious result of consciously forming and pursuing one's goals.

However, research over the last 2 decades has challenged this view. There is a bulk of experimental work showing that, on the basis of the notion that goals are mentally represented as desired outcomes resulting from more concrete actions (Aarts & Dijksterhuis, 2000; Bargh, 1990; Kruglanski, 1996), mere activation of a goal representation motivates behavior and higher mental processes involved in goal-directed behavior, such as maintaining the goal active and monitoring its progress (for overviews, see Custers & Aarts, 2005b; Dijksterhuis, Chartrand, & Aarts, 2007). The idea that our goal pursuits also materialize nonconsciously may sound counterintuitive because the actions we conduct and the outcomes they produce are often accompanied by feelings of agency. How can much of our behavior unfold outside conscious awareness if we have those pervasive agency experiences? A possible answer to this question is that agency experiences not only arise from our conscious goal pursuits but accompany our nonconscious goal pursuits as well, leading us to believe that the outcomes of our behaviors were consciously intended, whereas in fact they were influenced by cues in our environment outside our conscious awareness.

But how can agency experiences arise from nonconscious goal pursuit? A possible way to understand this issue is by suggesting that our conscious experience of self-agency or, as discerned by Prinz (2003), willful causation is an inference that occurs fluently and perfunctorily after action performance and is not accurate per se (see also Bargh, 2005; Wegner, 2002). This inferential character of experiences of self-agency has become apparent in a number of recent studies (Aarts, 2007b; Aarts, Custers, & Wegner, 2005; Jones, de-Wit, Ferneyhough, & Meinz, 2008; Sato & Yasuda, 2005; Wegner & Wheatley, 1999) demonstrating that these experiences are the result of a match between the outcome of an action and knowledge about the outcome that was made active just prior to its occurrence.

Building on and extending this previous work, we aim to integrate two important lines of literature in the field of social cognition by examining how nonconscious goal pursuit and the experiences of self-agency are connected to each other. In particular, we argue that, on the basis of the idea that goals contain a representation of the

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desired outcome as well as an affective component that signals potential reward (Custers & Aarts, 2005a; Fishbach & Ferguson, 2007), priming an outcome representation just before the outcome is produced should promote experiences of self-agency, even when the outcome is actually caused by an external source. Moreover, we propose here that when the outcome that is primed by the environment is accompanied by a positive affective (reward) signal and hence that outcome represents a goal one is motivated to attain, the mechanisms that drive nonconscious goal pursuit will sustain the activation of the outcome representation. The agency feelings may therefore not be the direct result of one's wanting but rather a by-product of the mechanism that keeps the representation of outcomes active over time, even when the outcome is activated relatively long before the actual outcome is produced. Accordingly, the present article presents four experiments to examine the intriguing possibility that the mechanism that facilitates maintenance of nonconscious goals actually produces experiences of self-agency.

The Establishment of Self-Agency Experiences

The experience of self-agency appears quite natural to us. Whether our jokes make our colleagues smile or lights turn on when we push the switch as part of our routine of entering the office in the morning, our actions and their effects in the external environment are often felt to be caused by ourselves. The establishment of self-agency requires specific mechanisms that have been elucidated only recently. From research in this domain we know that the processing of self-agency draws on a variety of authorship indicators (Wegner & Sparrow, 2004), such as direct bodily feedback (e.g., Gandevia & Burke, 1992; Georgieff & Jeannerod, 1998), direct bodily feedforward (e.g., Blakemore & Frith, 2003; Blakemore, Wolpert, & Frith, 2002), and visual and other indirect feedback (e.g., Daprati et al., 1997). In essence, these signals all provide us with information about the outcome of our actions.

Research proposes different accounts of how such outcome information is linked to the conscious experience of self-agency. For instance, studies that focus on conscious awareness of motor behavior suggest that self-agency arises from predictive motor control processes before actual bodily movement takes place. Specifically, awareness of intentional action (e.g., grabbing a glass) is not based on actual body position but on the predicted position derived from efferent commands in the motor control system (Blakemore et al., 2002; Haggard, 2005). In social psychological models of goal-directed behavior, self-agency is often seen as a product of a comparison between expected and actual outcomes. According to this account, self-agency emerges when the perception of an outcome corresponds with the outcome that one consciously intends to attain by performing an action (e.g., Bandura, 1986; Carver & Scheier, 1998; Deci & Ryan, 1985).

However, it may be questioned whether feelings of self-agency originate from only intentional processes. Since self-agency experiences rely on a match between represented outcomes and the actual observation of these outcomes, the authorship ascription process may be susceptible to primes that render the representation of outcomes active before one performs an action and observes the matching outcome. According to Wegner (2002, 2003), in such cases the mind can produce a heightened sense of authorship for its owner, which leads to *apparent mental causation*: the experience we have of causing an outcome that arises whenever our thoughts preceding the outcome match the outcome and are inferred to cause it—whether we truly caused it or not. Experienced self-agency may therefore be augmented merely because the representation of an outcome is primed just before one performs an action and then observes the outcome.

There is some research pointing to this possibility. In one study (Aarts et al., 2005), the participant and the computer each moved a single gray square in opposite directions on a rectangular path consisting of eight white tiles. Participants' task was to press a key to stop the rapid movement of the squares. This action turned one of the eight tiles black. In reality, the computer determined which of the tiles would turn black. From a participant's perspective, though, this black tile could represent the location of either her square or the computer's square at the time she pressed the *stop* key. Thus, the participant or the computer could have caused the square to stop on the position (outcome), rendering the exclusivity of causes of outcomes ambiguous (Wegner & Wheatley, 1999). Participants either set the intention to stop on a position or were subliminally primed with that position just before they saw the presented stop on the corresponding location. To measure experiences of self-agency, participants rated the extent to which they felt that they caused the square to stop on the presented location. Results showed that both intention and priming lead to an increased sense of self-agency, suggesting that on-line self-agency feelings were primarily based on a match between preactivated and actual outcomes, irrespective of the (conscious or nonconscious) source of this activation. Moreover, the priming effects on self-agency were not mediated by actual control (see also Jones et al., 2008). This illusory experience of self-causation has been shown to occur even in depressed persons, who are commonly thought to be less sensitive to such control illusions (Aarts, Wegner, & Dijksterhuis, 2006), indicating that a match between primed and observed outcomes plays a fundamental role in the establishment of personal authorship.

Nonconscious Goals and Their Pursuit

The studies on authorship ascription discussed above suggest that observing outcomes that are primed in one's mind engenders inferences of self-agency independent of actual causation. However, outcome priming does not only affect the interpretation of perceived outcomes. Outcome priming can also influence executive processes relevant for producing the outcome. Departing from an instrumental action perspective (Dickinson, 1994; Thorndike, 1911), Elsner and Hommel (2001; Hommel, 1996) proposed that the link between actions and effects is bidirectional and that individuals establish this link when effects are perceived to result from action performance. Therefore, priming the representation of the effect increases the tendency to execute the associated action. To test this idea, Elsner and Hommel (2001) first taught participants to randomly alternate two actions that were consistently followed by a specific outcome (e.g., pressing a left key produced a loud tone, and pressing a right key produced a soft tone). After practice, participants were primed with the outcome just before a response was required. It turned out that random responding became more difficult, as was revealed by a response bias toward the primed outcome. These results suggest that representations of outcomes (e.g., loud tone) that previously served as actual effects of actions (e.g., pressing a left key) can operate as a goal for people's actions.

In contemporary cognitive approaches to behavior, the representation of an outcome is often considered to be the building block of

goal-directed behavior. Specifically, goals are conceptualized as mental representations of desired behaviors or outcomes resulting from lower level acts and skills that provide a current reference point for cognition and action (Aarts & Dijksterhuis, 2000; Jeannerod, 1997; Vallacher & Wegner, 1987). According to this view, any outcome that is represented in terms of a result of more concrete action can potentially operate as a goal if one is motivated to attain it.

That priming the representation of a goal can influence action control processes directly has been advanced in recent work (Dijksterhuis et al., 2007). Indeed, activating the representation of a goal outside of awareness (i.e., subliminal goal priming) prepares people to execute associated actions. An important issue recently addressed is how such priming effects acquire an intrinsic motivational property, such that people are motivated to guide cognition and action in accord with the primed goals (Bargh, 2006). Such motivational properties have been demonstrated in studies in which people who are primed with the representation of desired goals (e.g., performing well, earning money, socializing) display motivated behavior (e.g., enhanced effort) in the absence of (a) conscious intent and (b) awareness of the activation of the goal. Moreover, goal priming has been shown to motivate not only behavior but also mental processes that render goal attainment more effective. Bargh, Gollwitzer, Lee Chai, Barndollar, and Trötschel (2001) showed that goal-priming effects on behavior survived a 5-min delay. Building on the notion that nonmotivational (semantic) items show a rapid decay of activation over short periods of time, usually within a couple seconds (Forster, Booker, Schacter, & Davis, 1990; Joordens & Becker, 1997; McKone, 1995), Aarts, Custers, and Holland (2007) established that a subliminally primed goal remained mentally active for 2 min but that the sustained activation faded away quickly as soon as the motivational value of that goal was gone. This persistent character of goal-priming effects on cognition and behavior suggests that motivation keeps the representation of a goal active and stable to facilitate goal attainment (see Aston-Jones & Cohen, 2005, for a possible neuroscientific account for this focused attention process).

Whereas several studies have revealed that priming motivates people to engage in goal-directed processes of attaining an outcome, researchers have just begun to explore the basic principles underlying the motivation of our goal pursuits in the absence of conscious will. Studies into incentive learning and the neurological mechanisms involved in motivation (Berridge, 2007; Robbins & Everitt, 1996; Toates, 1986) suggest that humans readily become motivated to produce an outcome when the outcome is attached to positive affect as a result of rewarding cues (e.g., food, money, or a smile), even if the cue is presented subliminally (Bijleveld, Custers, & Aarts, 2008; Pessiglione et al., 2007). According to this work, the mechanism that turns a subliminally primed representation of an outcome into a temporary goal state that one is motivated to maintain and attain relies on the tagging of positive affect to the primed outcome, as such positive valence, in principle, offers a reward signal for attaining the outcome (Aarts, Custers, & Marien, 2008; Bargh & Huang, in press).

Of particular importance for the present work is recent research on the role of positive affect as an implicit motivator in goal-directed behavior. For instance, Custers and Aarts (2005b, 2007) showed that subliminally priming a potential goal (i.e., the representation of an outcome of lower level actions such as solving puzzles) enhanced participants' motivation (e.g., enhanced effort) to attain the goal, and these effects were more pronounced for people who more strongly associated the goal with positive affect (see also Ferguson, 2007). In another line of research (Aarts, Custers, & Marien, 2008; Custers & Aarts, 2005a; Veltkamp, Aarts, & Custers, 2008) they experimentally created a nonconscious goal by directly pairing a subliminally primed potential goal with the activation of positive affect (exposure to words such as *smile* or *nice*). They showed that this coactivation of a goal and positive affect, as opposed to neutral and negative affect, increased participants' motivation to attain the goal to the same extent as a conscious goal does (cf. Bargh et al., 2001). Moreover, they established that if a potential goal is coactivated with positive affect outside of conscious attention, the goal was still active after a 2-min delay (Aarts, Custers, & Veltkamp, 2008). These latter results indicate that an outcome representation that is activated outside awareness and attached to a positive affective (reward) signal, is kept active over time in the service of goal pursuit.

From Nonconscious Goals to Conscious Experiences of Self-Agency

So far, our conceptual analysis indicates that experiences of self-agency and nonconscious goal pursuit may rely on the same outcome information. That is, priming the representation of an outcome before it is produced enhances experiences of personal authorship. Furthermore, priming an outcome that is attached to positive affect motivates people to keep that outcome representation active in the course of goal pursuit. Ironically, then, the mechanism operating on the representation of an outcome that renders nonconscious goal pursuit more likely to occur would also facilitate the sense of self-agency.

It is important to emphasize that in the studies on outcome priming effects on self-agency conducted so far, the prime almost always occurred just before participants produced the outcome. As we noted before, the activation of primed items usually decays quickly within a few seconds, unless some intervention holds the item active (see also, e.g., Altmann & Trafton, 2002; Baddeley & Logie, 1999). This brief time window suggests that an outcome that is primed too far in advance may not yield the experience of agency, unless the outcome is attached to positive affect and thus represents a goal state that is kept active over time.

Indeed, in a recent study on authorship ascriptions of outcomes to oneself or the computer, Sato and Yasuda (2005) established that an intentionally selected action to produce an outcome allows for a longer temporal delay to increase ratings of experienced self-agency than does an action that is induced involuntarily (see also Knoblich & Sebanz, 2005). More relevant for the present research, Wegner and Wheatley (1999) showed that the effects of priming on self-agency judgments did show up only if outcomes were primed 1 s in advance but that this effect attenuated rapidly when the time between priming and producing the outcome increased (between 5 s and 30 s). This suggests that it was not so much a motivational goal state that operated outside of awareness and influenced the experience of self-agency but rather the mere representation of the outcome that matched the observed outcome close in time (Eagleman & Holcombe, 2002). The questions of whether and how implicit motivation to produce an outcome impinges on the process involved in the experience of self-agency,

then, are still open for investigation. The present research is concerned with this issue.

The Present Research

Four experiments were designed to examine the relation between nonconscious goals and the conscious experiences of self-agency outlined above. Specifically, we aimed to test whether an outcome representation that is primed and followed by an action that causes the outcome leads to augmented feelings of self-agency. Crucially, we aimed to show that these effects can occur even when outcome information is primed subliminally and relatively far in advance. In particular, we argued that when an outcome is coactivated with positive affect, that outcome operates as a motivational goal state. As a consequence, the representation of the outcome is more likely to be kept active over time and thus can enhance experiences of self-agency when it matches with the observation of the actual outcome, even if the time between priming and the occurrence of the outcome is relatively long.

To examine our ideas we developed a task that combines manipulations recently employed in research on implicit motivation of goal pursuit (Aarts, Custers, & Marien, 2008; Custers & Aarts, 2005b) and online experiences of self-agency in a task where the cause of outcomes is unclear and agency experiences can occur independent of actual causation (Aarts et al., 2005; Wegner & Wheatley, 1999). In this task participants first learned to stop a sequence of six colors rapidly presented on the computer screen by pressing a key, which was immediately followed by the presentation of a particular color. Participants were told that this color was the result of their action. Next, they learned that during the rest of the experiment the colors in the sequence would be removed and replaced by six briefly flashed letter strings and that pressing the *stop* key during the alternation of these strings would produce one of the previous six colors. In addition, they were told that the presented color might also be determined by the computer. It was explained that this adaptation of the task was used to examine experiences of agency when the connection between action and outcome is unclear (cf. a slot machine, on which one stops rapidly rolling symbols by pushing a button). In reality, the computer always determined the color. However, from a participant's perspective the color displayed after pressing the *stop* key could represent the outcome of her action. Thus, the task was devised in such a way that either the participant or the computer could be the cause of the presented color, rendering the exclusivity of the cause of outcomes ambiguous. As a measure of self-agency (Aarts et al., 2005; Sato & Yasuda, 2005; Wegner & Wheatley, 1999), participants indicated to what extent they felt that they had produced the presented color.

The replacement of the colors by letter strings served three important experimental purposes: (1) The presentation of the letter strings prevented participants from determining which color was on the screen at the moment they pressed the key to stop the sequence of colors and hence from using them as a predictor for the observed outcome; (2) removing the colors and presenting the letter strings ensured that the colors would not serve as primes by themselves during the sequence interval; and (3) the sequence of strings allowed us to prime specific outcome information (i.e., color names, such as the word *blue*) in the absence of participants' awareness either relatively far (20 s) or close (1 s) in advance before they stopped the sequence and to coactivate the outcome with positive affective stimuli. Thus, although our task allowed participants to have agency over the execution of the action (pressing the *stop* key), they could not predict the outcome of that action. In this way, experiences of self-agency over outcomes were rendered sensitive to our manipulations of priming, timing, and positive affect.

Experiment 1 was conducted to test our new paradigm and to replicate previous findings of Wegner and Wheatley (1999). Specifically, whereas Wegner and Wheatley examined time-lag effects on self-agency by using conscious (auditory) outcome primes, here we aimed to demonstrate that subliminal (visual) outcome primes (the stopped colors) enhance the experience of self-agency when the outcome information is primed just before the stop (1 s) but not when it is primed too far in advance (20 s). Establishing this effect would provide initial support for the idea that the primed colors operate as nonmotivational primes and that their activation returns to baseline after 20 s. Experiment 2 concerned a test of the new prediction derived from our line of reasoning that the mechanism that facilitates active maintenance of nonconscious goals produces experiences of self-agency. Accordingly, we examined whether activating outcome information together with positive affect leads to enhanced experienced self-agency when this information is activated far in advance. Experiment 3 aimed to show that priming outcome information with positive affect augments experienced self-agency through activation of the outcome representation and is not a direct result of the positivity itself. Finally, Experiment 4 aimed to further test whether the long time-delay effects of coactivation of an outcome and positive affect on self-agency are due to maintenance of the activation of the outcome representation.

Experiment 1

Participants were either primed or not with a color (outcome information) before they stopped the letter string sequence and were subsequently presented with one of the six colors. The corresponding color name was primed just before they stopped the sequence (1 s) or relatively far in advance (20 s). On the basis of previous findings (Aarts et al., 2005; Wegner & Wheatley, 1999) and the assumption that the specific colors do not operate as a motivational prime in the task, we predicted that experienced self-agency would be augmented only when the color was primed just before participants pressed the *stop* key and observed the corresponding outcome. This interaction effect between priming and time lag was expected, on the basis of the rationale that outcome representations that do not operate as a motivational goal state are not maintained active over time and hence are less likely to be active at the time participants observe the outcome.

Method

Participants and design. Eighty-eight undergraduates participated in the study and received a small fee or course credits in return. They were randomly assigned to one of two conditions that varied in the time lag between priming and the required key press: short versus long. In addition, all participants were presented with two types of trials: trials in which outcome information (the color that would be presented after the key press) was primed and control trials without such primes. Hence, priming constituted a within-participant factor.

Experimental task and procedure. Participants worked on the task in separate cubicles. They were told that the study was designed to examine people's experiences of agency and how these experiences come and go. For this purpose, they had to perform a task whose outcome could be determined by their action but could also be determined by the computer. Specifically, they first learned to stop one of six colored squares (red, blue, green, yellow, purple, and brown) that were presented on the computer screen in rapid alternation, by pressing a designated key on the keyboard upon seeing the message ***STOP***. They were told that upon pressing the *stop* key, the rapid alternation of the colors would stop and that the color on which they had stopped the sequence would be presented on the screen. Thus, the presented color represented the outcome of their action. Each trial began with a start cue, proceeded with the alternation of the colored squares, and at some point, ended with the stop cue. The colored squares were presented for just 150 ms, with a 30-ms blank screen in between. The stopped color was presented 100 ms after participants pressed the *stop* key and remained on the screen for 1 s. All events were presented in the middle of the computer screen.

After some practice with the task, participants were told that the task would change a bit to examine experiences of agency when the connection between action and outcome was ambiguous. Specifically, they learned that the six colors would no longer be presented on the screen but instead would be replaced by six different strings of capital letters (e.g., GCVLHNRW) symbolizing the six colors. Hence, they were told that now stopping the sequence of briefly flashed letter strings would be followed by the presentation of a colored square, representing the possible outcome of their action of pressing the *stop* key. In addition, they were told that the presented color could also be determined by the computer (in fact, the computer always determined the presented color). Participants thus were led to believe that either they themselves or the computer could be the cause of the presented color. They were also told that the time of a trial could vary and that they therefore should keep focused on the strings during the task so as not to miss the stop cue (in actuality, each trial lasted about 25 s). After each presented color, participants indicated to what extent they felt that they had produced the color (by stopping the sequence). This agency judgment was measured on a 10-point answer scale ranging from 0 (*not at all me*) to 9 (*absolutely me*). Each of the six colors was presented as an outcome twice—once in the prime (match) condition and once in the no-prime (no-match) condition. The experimental task thus consisted of 12 trials. Trials were presented randomly. Participants first practiced the task to grasp the idea of how their key press could produce the presented color and then moved on to the experimental task.

Color word priming. The name of the color (in capital letters) was either primed or not within the presentation stream of letter strings (for a similar procedure, see Aarts et al., 2007; Custers & Aarts, 2005a). Each letter string was presented for 150 ms, and between two successive strings there was a 30-ms interval. As a default, a row of neutral *X*s was presented during this interval. In the prime trials a color name was presented on every third 30-ms interval for seven times in a row. Thus, the time between primes was 540 ms.

Time lag. In the long time-lag priming condition, the time between the last prime and the cue to stop was 20 s. In the short time-lag condition, the time between the last prime and the stop cue was 1 s.

Debriefing. As in our earlier work (Aarts et al., 2007), an awareness check ("During the sequence of letter strings, have you seen any other specific information being presented on the screen, and if yes, what kind of information?") showed that none of the participants reported having seen color words during the task. Furthermore, none of them realized the true nature of the study. We also asked participants how they had handled the task. Most of them said that it was quite difficult to assess whether they stopped the presented color, so, as suggested by the instructions, they relied on their feelings to arrive at an agency assessment. One participant reported having misunderstood the task instructions. In addition, 1 participant took an exceptionally long time to press the *stop* key upon the cue to stop. These 2 participants were omitted from the analyses.

Results

Self-agency ratings. Our main dependent variable was reported self-agency. Self-agency ratings were subjected to a 2 (prime: no vs. yes) within-participants × 2 (time lag: short vs. long) between-participants analysis of variance (ANOVA). First, priming the color was found to slightly enhance the experienced agency, but the main effect did not reach the conventional level of significance, $F(1, 84) = 1.71$, $p = .20$, $\eta^2 = .02$. Furthermore, the main effect of time lag was not significant, $F(1, 84) = 0.73$, *ns*. More importantly, however, the analysis of variance yielded a significant two-way interaction of prime and time lag, $F(1, 84) = 7.65$, $p = .007$, $\eta^2 = .08$.

To gain further insight into the two-way interaction effect and to test our specific prediction, we conducted planned comparison tests. These tests showed that in the short time-lag condition, the prime led to higher agency ratings than did the no-prime condition, $F(1, 84) = 8.29$, $p = .005$. However, this prime effect did not emerge in the long time-lag condition, $F(1, 84) = 1.06$, *ns*. Figure 1 presents the mean self-agency scores across conditions.[1]

Timing of responses. To check whether participants had timed their responses to the stop cue differently across the different conditions, we subjected response times to a 2 (prime: no vs. yes) within-participants × 2 (time lag: short vs. long) between-participants ANOVA. This analysis yielded no reliable effects, Fs < 1. The mean response time was 537 ms.

Discussion

The findings of Experiment 1 confirmed our prediction. Subliminally priming the name of a color just 1 s before participants stopped the sequence and saw that color enhanced their experienced self-agency in a setting in which the cause of the outcome was ambiguous. Priming did not affect participants' reactions to the stop cues, indicating that priming effects on self-agency could not be attributed to differences in behavior. Conceptually replicating earlier work by

[1] In a separate experiment using the short time lag trials, we included an additional condition in which the primed and observed color did not match. The results of this experiment showed that this condition produced similar results on self-agency as the condition in which colors were not primed at all (and hence there was also no match between a primed and observed color). These findings indicate that the effects of color priming on enhanced self-agency were not due to color priming per se but were the result of a match between the primed and observed color.

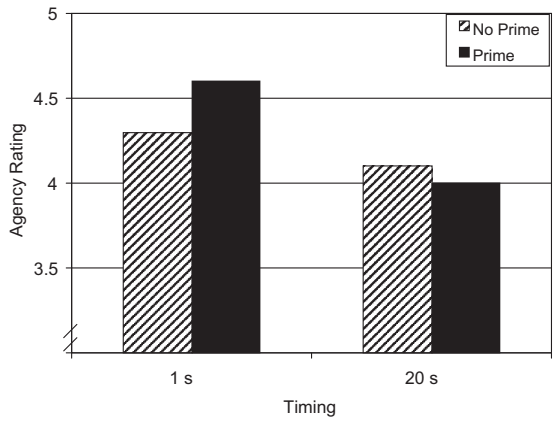

Figure 1. Experienced self-agency as a result of prime (no vs. yes) and time lag (short vs. long).

Wegner and Wheatley (1999) for the first time in a different paradigm, we found that these outcome priming effects on self-agency did not emerge when the outcome was primed relatively far in advance (20 s), suggesting that the activation of the representation of the outcome had returned to baseline by the time participants performed the action and observed the outcome. These findings suggest that, based on the notion that outcome information is maintained active for a critical period of time when the outcome operates as a motivational goal, stopping a specific color did not constitute a goal for participants. In other words, activating the concept of blue outside awareness far in advance did not cause participants to want to stop the sequence on the color blue in the task.

Experiment 2

Experiment 2 served one important purpose. In this experiment, we aimed to connect the mechanism that maintains a nonconscious motivational goal state active to the process involved in the production of the experiences of self-agency. As pointed out before, coactivating outcome information with positive affect causes that outcome to operate as a motivational goal state. Once this goal is in place, the person is more likely to keep the outcome representation active over time, even though she is not aware of the operation of the goal in mind (Aarts, Custers, & Veltkamp, 2008). In other words, motivational goal states operate nonconsciously in short-term memory to maintain goal-relevant information active (see Maljkovic & Nakayama, 2000, and McKone, 1995, for evidence of nonconscious processes in short-term memory). Self-agency of producing an outcome thus may be enhanced because the outcome representation is still active at the time a matching outcome is observed. Therefore, priming outcome information relatively far in advance is expected to increase experienced agency only when the outcome is linked to positive affect.

To test this prediction, we primed participants 20 s before they had to press the key and observe the presented color. In some trials they were primed with the color word, in other trials they were primed with positive affective words, and in yet other trials they were primed with the color in temporal proximity to the activation of positive affect. Hence, to create the nonconscious goal of stopping the sequence at a specific color, we subliminally presented both color words and positive affect words (see, e.g., Dijksterhuis, 2004; Dijksterhuis & Aarts, 2003; Stapel, Koomen, & Ruys, 2002, for the effective nonconscious processing of affective stimuli, even in a coactivation task). If the coactivation of the color and positive affect created a nonconscious goal to stop the sequence on that color, then that goal representation would remain active during the 20-s interval and, accordingly, enhance people's experiences of self-agency upon observing the stopped color.

Method

Participants and design. Forty-eight undergraduates participated in the study and received a small fee or course credits in return. The design of this experiment consisted of three within-participants conditions (prime only vs. positive affect only vs. prime plus positive affect).

Experimental task and procedure. The task, procedure, and instructions were similar to those for Experiment 1, with a few modifications. In this experiment, we used only the long time-lag condition. In the prime-only condition trials, participants were presented with a color word 20 s before stopping the sequence, as described in the procedure of Experiment 1. Furthermore, we had two other types of trials in addition to the prime-only condition. The prime-plus-positive-affect condition trials were the same as the prime-only condition trials except that the color words were followed by the presentation of a positive word (randomly selected from the following list of words: *pleasant, fun, beautiful*) on the next 30-ms interval. The positive-affect-only condition trials were in turn the same as the prime-plus-positive affect condition except that the color words were replaced by the default string of *X*s. It should be noted that in this procedure, the color primes as well as the positive affective words were always immediately postmasked by the letter strings. As in Experiment 1, the time between the last prime and the stop cue was 20 s. The experimental task consisted of 18 trials that were randomly presented, since each color was presented once in each condition.

Debriefing. Debriefing showed that none of the participants had seen the color primes or the positive words.[2] Furthermore, none of the participants realized the true nature of the study.

[2] We conducted a subliminality test to check whether the color primes could be consciously perceived. An independent sample of participants ($N = 63$) performed 24 short trials that involved the same procedure and timing as in Experiment 1. They were informed that there was a 50% chance that a trial would contain a color word and that their task was to indicate after each trial (instead of making an agency judgment) whether a color name had been presented. In order to test whether the positive affect primes influenced the perception of the color primes, we presented all six color names once with and once without affect words (see Experiment 2). Of course, these trials were matched by 12 trials without primes: 6 without and 6 with affect words. Results revealed that overall accuracy was not different from chance level (50.2%), $t(1, 62) = 0.24$, $p = .81$, and that there was no difference in accuracy between the trials with and without the affect primes, $t(1, 62) = 1.05$, $p = .30$. These results demonstrate that our priming procedure prevented people from consciously perceiving the color primes and hence also from being aware of the relation between these primes and the presented affect words.

Results and Discussion

Self-agency ratings. The self-agency ratings were subjected to a three-condition (prime only vs. positive affect only vs. prime plus positive affect) within-participants ANOVA. The analysis revealed a significant effect, $F(2, 94) = 3.58$, $p = .03$, $\eta^2 = .07$. To test our specific hypothesis, we conducted a planned contrast test to analyze the predicted effect of the experimental treatment (prime only = positive affect only < prime plus positive affect) on the experienced self-agency measure. This test revealed that participants felt more self-agency in the prime-plus-positive-affect condition than in the prime-only and positive-affect-only conditions, $F(1, 47) = 5.78$, $p = .02$. Figure 2 shows the mean self-agency ratings for each condition.

Timing of responses. We subjected the response times to a three-condition (prime only vs. positive affect only vs. prime plus positive affect) within-participants ANOVA. This analysis yielded no reliable effect ($F < 1$), showing that the three conditions did not differ in the speed with which participants responded to the stop cue. Hence, the manipulation did not alter participants' stopping behavior itself. The mean response time was 571 ms.

Whereas Experiment 1 already demonstrated that priming the outcome of an action (the color presented after stopping the sequence) relatively far in advance does not enhance people's experiences of self-agency, the current findings demonstrate that mere activation of positive affect has no different effects on experienced agency. However, an augmented sense of self-agency showed up when the outcome was coactivated with positive affect, which is assumed to create a goal to produce the outcome (e.g., stopping on blue). Interestingly, although our data show that the nonconscious creation of a goal to produce an outcome enhances conscious experiences of self-agency upon observing the corresponding outcome, other research suggests that such experiences do not always show up as a result of priming a goal (e.g., Aarts, Gollwitzer, & Hassin, 2004; Bargh et al., 2001). One possibility for these seemingly diverging results is that the present effects ensue from a match between a nonconsciously active goal and the observed outcome of one's action, whereas in earlier work such a match might have been absent or less noticeable to participants, thus not easily yielding inferential experiences of self-agency.

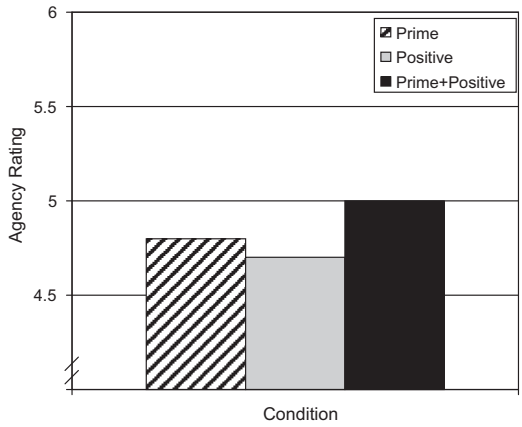

Figure 2. Experienced self-agency as a result of prime only, positive affect only, and prime plus positive affect under long time-lag condition.

Experiment 3

The findings of Experiment 2 strongly suggest that effects on experienced self-agency are due to active maintenance of the goal representation during the delay (Aarts et al., 2007), as the effects mimicked those that resulted from mere priming of the outcome just before the outcome occurred (Experiment 1). These findings are in line with the idea that when the representation of the outcome is active upon seeing the production of the outcome, either because of short-term lag priming or active maintenance resulting from a nonconsciously created goal, the match between the two offers the signal that one was the agent of the outcome.

However, although our data may favor an active maintenance account, there may be another explanation for the effects, in terms of the positivity of the outcome itself. From attribution research (Miller & Ross, 1975) we know that people are more inclined to attribute positive outcomes (success) rather than negative ones (failure) to the self. Whereas these self-serving biases have been linked to a need system for self-esteem (Campbell & Sedikides, 1999; Shepperd, Malone, & Sweeny, 2008) and hence are more likely to occur when people are motivated to work on their self-view, the positivity of the outcome offers an alternative explanation for the enhanced agency findings of Experiment 2: It could have been the case that the activation of the outcome actually returned to baseline during the 20-s interval, but participants claimed authorship based on the manipulated positivity of the outcome. According to this notion, coactivation of the outcome with positive affect would enhance experiences of agency through a mechanism that is different from, and totally independent of, the one that causes the priming effect obtained in Experiment 1. If this were the case, one would expect additive effects in a setting in which both mechanisms could operate at the same time. Experiment 3 was designed to examine this alternative hypothesis.

In this experiment, we primed outcomes in concert with positive affect just before participants produced the outcomes, which ensured that the outcome representation was both activated and positive, and compared the effect on agency ratings with that of merely priming the outcome. To this end, we used the short time-lag (1 s) condition employed in Experiment 1 in combination with the experimental design of Experiment 2. Accordingly, in some trials participants were primed with the color word just before stopping the color, in other trials they were primed with positive affect, and in yet other trials they were primed with the color in temporal proximity to the activation of positive affect. If manipulating the positivity of the outcome would raise agency feelings independent of priming effects, self-agency feelings should be higher in the prime-plus-affect condition than in the prime-only condition, in which the representation of the outcome was merely activated. If no such difference were found, one would have to conclude that increased positivity does not directly affect agency ratings and that therefore the effects of Experiment 2 would have to be the result of sustained activation of the outcome representation.

Method

Participants and design. Thirty undergraduates participated in the study and received a small fee or course credits in return. The design of this experiment consisted of three within-participants

conditions (prime only vs. positive affect only vs. prime plus positive affect).

Experimental task and procedure. The task, procedure, and instructions were similar to those for Experiments 1 and 2, with a few modifications. To leave no room for sustained activation effects, we used only the short time-lag priming condition and shortened the procedure between the start of a trial and the moment that participants stopped the color. Specifically, upon starting a trial, the sequence of alternating letter strings always lasted for 5 s, with rows of *X*s in between. After that, one of three things happened: the color word was presented seven times on its own (prime-only trials), the color word was presented seven times followed by positive words (prime-plus-positive-affect trials), or positive words were presented seven times on their own (positive-affect-only trials). One second after the primes and/or color words, the stop cue appeared. Thus, by comparing prime-only trials with prime-plus-positive-affect trials we could analyze whether effects on self-agency were caused by the mere activation of the outcome or also by its positivity. The task consisted of 18 trials that were presented randomly.

Debriefing. Debriefing showed that none of the participants had seen the color primes. They also had not seen the positive words. Furthermore, none of the participants realized the true nature of the study. Data of 1 participant were lost due to a technical error. Furthermore, 1 participant reported suffering from severe concentration problems during the task. Therefore, the data of these 2 participants were omitted from the analyses.

Results and Discussion

Self-agency ratings. The self-agency ratings were subjected to a three-condition (prime only vs. positive affect only vs. prime plus positive affect) within-participants ANOVA. The analysis revealed a significant effect, $F(2, 54) = 6.33$, $p = .003$, $\eta^2 = .19$. Planned comparisons revealed that participants experienced higher levels of self-agency in the prime-only trials than in the positive-affect-only trials, $F(1, 27) = 10.12$, $p = .004$. Furthermore, participants also experienced higher levels of self-agency in the prime-plus-positive-affect trials than in the positive-affect-only trials, $F(1, 27) = 5.13$, $p = .03$. Importantly, the experienced agency did not differ between the prime-only trials and the prime-plus-positive-affect trials, $F(1, 27) = 1.23$, *ns.* Inspection of the means revealed that priming-plus-positive affect did not raise experienced self-agency above the condition of priming alone. Figure 3 shows the mean self-agency ratings for each condition.

Timing of responses. We subjected the response times to a three-condition (prime only vs. positive affect only vs. prime plus positive affect) within-participants ANOVA. This analysis yielded no reliable effect, $F < 1$, showing that the three conditions did not differ in the speed with which participants stopped the sequence. The mean response time was 401 ms.

To summarize, the data of Experiment 3 show that priming the outcome (i.e., color) just before the outcome was produced increased the experience of self-agency of producing the outcome, thus replicating the findings of Experiment 1. Furthermore, pairing the outcome with positive affect did not further increase this effect. This pattern of data suggests that, at least in the present task, in which the exclusivity of the causes of outcomes is ambiguous and agency assessments occur online during action performance, it was the activation of the outcome representations that influenced experiences of personal authorship, rather than the positivity of the outcome per se. Although self-serving biases have been demonstrated in other settings (Shepperd et al., 2008), they do not occur in the present paradigm because, in all likelihood, producing colors on a computer screen is not a task that is relevant for people to work on their self-view per se.

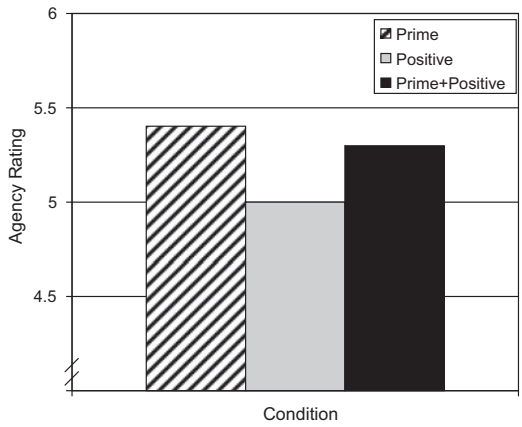

Figure 3. Experienced self-agency as a result of prime only, positive affect only, and prime plus positive affect under short time-lag condition.

Experiment 4

So far, our data indicate that priming an outcome outside of conscious awareness just before observing the actual production of the outcome leads to experienced self-agency of these outcomes. These effects also occur when the outcome is primed relatively far in advance, but only when the outcome information is linked to positive affect and thus operates as a nonconscious goal one wants to attain. We reasoned that in both cases the representation of the outcome is active at the moment one produces the outcome, only for different reasons. In the short time-lag condition, the representation is active due to mere priming. In the long time-lag condition, however, the activation decays rapidly over time but the coactivation of the outcome and positive affect creates a nonconscious goal that keeps the outcome representation active during the delay, and therefore it still provides a matching signal upon the observation of the outcome. The fourth experiment was designed to test this active maintenance account even more conclusively.

In this experiment, one group of the participants was primed with the outcome information (color) far in advance, while the other group was primed with the outcome together with positive affect far in advance. Furthermore, both groups of participants were either primed or not with the respective color just before they stopped the color. Thus, we could examine the interaction effects on self-agency between the creation of a nonconscious goal far in advance and mere priming just a little in advance. Based on the findings of Experiments 1–3 and research on decay functions of activated items in memory (Altmann & Trafton, 2002; Anderson, 1983; Higgins, Bargh, & Lombardi, 1985; McKone, 1995), the following predictions could be made: If the outcome is merely primed far in advance, then the activation of the outcome should return to baseline during the 20-s interval, whereas coactivation

with positive affect far in advance should keep the representation active. Hence, agency rating should be higher in the condition if primes and positive affect are coactivated. However, when the outcome is primed without positive affect far in advance, additional priming just before participants press the *stop* key should reactivate the outcome representation, which should increase agency ratings. But if the outcome is coactivated with positive affect far in advance, additional priming should not affect agency ratings, as the representation would be maintained active during the 20-s delay.

Method

Participants and design. Fifty-six undergraduates participated in the study and received a small fee or course credits in return. They were randomly assigned to the long time-lag goal creation or the long time-lag no goal creation condition. In addition, all participants received two types of trials: one where outcome information was primed just before they stopped the sequence and one where this was not the case. This latter factor thus constituted the within-participants short time-lag priming variable.

Experimental task and procedure. The task, procedure, and instructions were similar to those for Experiments 1–3. However, this experiment employed a combined manipulation of these experiments. Specifically, in this fourth experiment we either linked the color to positive affect or not 20 s before participants had to stop the color. Accordingly, one group of participants (long time-lag no goal creation condition) were exposed to only a color word 20 s in advance, whereas another group (long time-lag goal creation condition) was primed with the color word close together with positive affect 20 s in advance. Furthermore, all participants were either primed with the corresponding color word (short time-lag priming) or not (short time-lag no priming) 1 s before they stopped the color. The experimental task consisted of 12 trials that were presented randomly.

Debriefing. Debriefing showed that none of the participants had seen the color primes. They also had not seen the positive words. Furthermore, none of the participants realized the true nature of the study.

Results and Discussion

Self-agency ratings. The self-agency ratings were subjected to a 2 (long time-lag goal creation: no vs. yes) between-participants × 2 (short time-lag priming: no vs. yes) within-participants ANOVA. First, long time-lag goal creation overall slightly enhanced the experienced agency, but this effect was not significant, $F(1, 54) = 2.49$, $p = .12$, $\eta^2 = .04$. Furthermore, short time-lag priming increased the feeling of self-agency to some extent, but the main effect did not reach the conventional level of significance too, $F(1, 54) = 3.53$, $p = .07$, $\eta^2 = .06$. More importantly, however, the ANOVA yielded a significant two-way interaction, $F(1, 54) = 7.91$, $p = .009$, $\eta^2 = .13$.

To gain further insight into the two-way interaction effect and to test our specific prediction, we conducted planned comparison tests. These tests showed that in the no long time-lag goal creation condition, short time-lag priming augmented the feeling of self-agency, $F(1, 54) = 10.16$, $p = .002$, thereby replicating the earlier findings of Experiments 1 and 3. However, the short time-lag priming effect did not show up in the long time-lag goal creation condition, $F(1, 54) = 0.50$, *ns*. Furthermore, long time-lag goal creation enhanced experienced agency in the no short time-lag priming condition, $F(1, 54) = 4.51$, $p = .04$, whereas the long time-lag goal creation effect was absent in the short time-lag priming condition, $F(1, 54) = .99$, *ns*. The mean self-agency scores across conditions are presented in Figure 4.

Timing of responses. To check whether participants timed their responses differently in the different conditions, we subjected the response times to a 2 (short time-lag priming: no vs. yes) within-participants × 2 (long time-lag goal creation: no vs. yes) between-participants ANOVA. This analysis showed that long time-lag goal creation slowed down the response a bit, but this main effect was not significant, $F(1, 54) = 1.90$, $p = .14$, $\eta^2 = .03$. The main effect of short time-lag priming and the interaction effect were not reliable, Fs < 1.42. The mean response time was 485 ms.

In short, the findings of Experiment 4 indicate that, in line with predictions, creating a nonconscious goal to stop a specific color far in advance increased the experienced self-agency without additionally priming the color just before the participants stopped it, whereas priming the color just before stopping it elevated the sense of self-agency when the goal was not created far in advance. These findings thus offer further evidence for the notion that outcomes that are coactivated with positive affect remain active, which increases participants' sense of self-agency upon producing the outcome as a result of a match between the active and observed outcome.

General Discussion

The present study examined how the conscious experience of personal authorship over outcomes may result from the goal to produce the outcome outside of conscious awareness. Our approach in linking nonconscious goals to experiences of self-agency is built on recent advances showing that nonconscious goal pursuit emerges from two interactive sources (Bargh & Huang, in press; Custers & Aarts, 2005a): the representation of a goal or outcome and an accompanying positive reward signal maintaining the out-

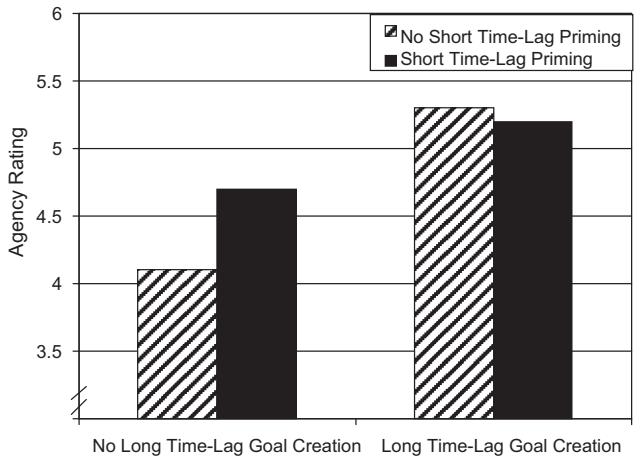

Figure 4. Experienced self-agency as a result of long time-lag goal creation (no vs. yes) and short time-lag priming (no vs. yes).

come representation active in the service of goal achievement. Accordingly, across a series of experiments we employed a task in which either the participant or the computer could cause a specific outcome to occur and demonstrated that participants' experience of self-agency in producing the outcome is enhanced when either (a) the representation of the outcome is primed just before producing the outcome and not when the outcome representation is primed too far in advance or (b) the outcome representation is primed far in advance and is attached to positive affect, which thereby constitutes a nonconscious goal to produce the outcome that keeps the outcome representation active until the time of producing the outcome. Taken together, then, the present research provides new and important findings that show how the conscious experience of self-agency and nonconscious goal pursuit are connected as a result of a match between an activated outcome and the later production of the outcome. As such, our study brings together two lines of research that so far have led relatively separate lives.

An important contribution of the present study lies in demonstrating how outcome information presaged in people's mind enhances their conscious experiences of self-agency. So far, research on the experience of self-agency has mainly focused on the understanding of the mechanism underlying authorship processing resulting from intentional action. The principles proposed in the literature that give rise to the experience of self-agency concern either a predictive process in which internal motoric information provides a signal for the feeling of doing or an inferential process involving a match between the mental representation of the expected outcome that one consciously intended to produce and the actual occurrence of it. Knowledge of the effects of our actions before we perform them serves as key input for establishing a sense of our own agency, especially when the cause of actual outcomes is ambiguous (Heider, 1958; Jeannerod, 2003; Michotte, 1963; Wegner, 2002). Whereas the current debate on this issue focuses on the question of whether a sense of self-agency occurs before overt action is performed or only after the action is performed and feedback is received (Knoblich & Sebanz, 2005; Moore & Haggard, 2008), the current research suggests that people do not have to form an a priori explicit intention to perform behavior or to produce an outcome for self-agency to be augmented. What matters is whether the representation of the outcome is active at the moment people perform an action that seemingly causes the outcome.

Importantly, previous work in this area has demonstrated that such outcome priming effects on self-agency emerge only when the primed and actual outcome occur close together in time (Wegner & Wheatley, 1999). Extending this work, the present studies show that the time range in which these effects occur can be stretched when the outcome is primed and paired with positive affect. Moreover, our results suggest that the experience of self-agency is not the direct result of the positivity of the outcome itself but rather a side effect of the mechanism underlying goal pursuit that keeps the representation of outcomes active over time and can produce a sense of agency independent of actual behavioral causation. This observation concurs with research in social neuroscience showing that the production of behaviors and the assessment of authorship are handled by anatomically separate, distinct parts of the brain (i.e., motor vs. parietal cortex; Chaminade & Decety, 2002; Farrer & Frith, 2002), raising the possibility that we can experience personal authorship quite independent of any actual causal connection between our goals, actions, and outcomes. Accordingly, people may think they have caused outcomes when, in actuality, these outcomes were produced by an external source. Our findings, then, foster the idea that the conscious experience of personal authorship over outcomes can follow from an inferential mental state and is open to illusions, regardless of whether people are aware of the goal to produce the outcome.

Whereas our findings pertain to outcome priming effects on experiences of agency over outcomes of one's own action, agency experiences are also thought to be derived from sensations of the body's movement that occur both before and after action (Frith, Blakemore, & Wolpert, 2000). However, people may not readily rely on these sensory indicators in social situations in which (as in our task) the connection between action and outcomes is unclear and outcomes may be caused by other sources. For example, if a person suddenly acts friendly to you at a party, it is hard to infer from your own bodily cues whether your actions had anything to do with it. In such situations, agency experiences are more likely to be guided by outcome representations that are active in your mind when the outcome occurs. Unlike in our experiments, however, everyday experiences of agency are not necessarily illusory, as desired outcome representations (i.e., goals) that are activated outside awareness are also more likely to guide the actions that produce that outcome (Aarts et al., 2004; Bargh et al., 2001; Custers & Aarts, 2007). If, for instance, you want another person to like you, this changes your behavior toward that person even though you may not be aware of it. Hence, self-agency and nonconscious goal pursuit may go hand in hand, as nonconscious activation of goals promotes both goal attainment and agency experiences. As a result, agency experiences in such situations may not be deceptive but rather an accurate assessment of the source that produced the outcome. Although these experiences could be seen as a by-product of our nonconscious goal pursuits, they may serve us well because they can help us to identify the results of our actions in social situations when we lack conscious knowledge of producing them.

Nonconscious Sources of Conscious Experiences of Self-Agency

The present findings may offer a challenge to people's understanding of the way they arrive at experiences of self-agency and goal pursuits. Specifically, most of us appreciate the role of consciousness in behavior as part of the formation of intentions to attain a behavioral outcome, performing the corresponding behavior and observing the outcome to be attained. In doing so, we see the assessment of authorship as a straightforward affair. It is important to notice, though, that the mechanism that gives rise to personal authorship experiences as a result of intentionally determined behavior is, in essence, not different from the one examined in the present studies. That is, experiences of self-causation emerge when the conscious perception of an outcome corresponds with the outcome that is accessible, and hence, one infers that the outcome is the result of one's own action. Moreover, we demonstrated that an outcome is kept active over time, behaving like a goal, when it is primed together with positively valenced information outside of awareness, thereby enhancing the experience of self-agency upon conscious perception of producing the outcome (cf. Sato & Yasuda, 2005). The issue, then, that may require

further scrutiny concerns the question of how a goal state operates on incoming informational input that is accessible to conscious awareness, while at the same time the goal-directed attention to, and transformation of, that information occurs outside of conscious awareness.

One way to approach this matter is to assume that, like conscious goals, nonconscious goals rely on mental resources to maintain and manipulate information in the service of goal pursuit, and as such they represent a class of mental processes in which lack of awareness and effort do not go hand in hand (Aarts, 2007a; cf. Naccache et al., 2005). Basically, this view takes into account the functional architecture of information processing in which the same cognitive functions (Barrouillet, Bernardin, Portrat, Vergauwe, & Camos, 2007; Cocchini, Logie, Della Sala, & Baddeley, 2002) or hardware (Johnson, Strafella, & Zatorre, 2007; Szameitat, Schubert, Muller, & Von Cramon, 2002) are shared and recruited by different goals. This view of nonconscious goal pursuit resembles mainstream models of executive control or working memory in providing an account for the ability to guide attention and action in accord with goals (Miyake & Shah, 1999). However, *working memory* and *consciousness* are often considered to be synonymous terms (Baars & Franklin, 2003; Baddeley, 1993; Smith & Jonides, 1999), and hence, the functionality and structure of working memory are examined by presenting participants explicitly with materials that they explicitly have to work on. Under this assumption it is difficult to understand how goal pursuit is supported by higher mental processes that make use of executive control structures without the person being aware of it. However, the control structures in the brain (frontal cortices) that serve our goals have been proposed to operate independent of the structures that give rise to conscious awareness (Frith et al., 2000; Koch & Tsuchiya, 2007).

The view outlined above may have important implications for understanding the relationship between nonconscious goals and conscious experiences of self-agency. It can be proposed that, on the basis of research into interference effects in dual task settings, if a nonconscious goal and a conscious goal share the same cognitive function (e.g., active maintenance), then the operation of a nonconscious goal may be impaired when another conscious goal taxes the function or hardware that is involved with the nonconscious goal (Aarts, Custers, & Veltkamp, 2008; Badgaiyan, 2000; Oikawa, 2004). Accordingly, priming a motivational goal to produce an outcome augments the experience of self-agency upon attaining the outcome at issue, but these effects may be attenuated when people are hampered in maintaining the representation of the outcome active. Under these circumstances, experiences of self-agency are less likely to result from a match between a presaged outcome and the actual production of it, because the outcome representation is not active upon observing the outcome. However, self-causation claims are known to occur even in the absence of such an online match. In that case, self-serving biases may drive our agency attributions offline. Because this line of reasoning is speculative, an important avenue for future research would therefore be to carefully examine the content and working of the mind when people reflect on outcomes to understand whether experiences of authorship differ when they derive from goal-directed or wishful thinking.

Concluding Remarks

Whereas our behaviors may emerge from nonconscious mental processes, the conscious experience of personal authorship we have over them appears quite natural to us. Our experiences of self-agency often pertain to outcomes in the external environment. These experiences are real, pervasive, and socially well shared. Our mind must therefore have a method that operates through a cognitive mechanism that is tuned to easily offer a current agent for outcomes. Building on earlier work, in the present study we demonstrated the interactive role of outcome representations and positive affect in shaping self-agency experiences. In doing so, the present study may offer new directions in the study of self-agency and conscious experiences of goal pursuit. That is, our work may promote a better understanding and examination of how the experience of self-agency originates in nonconscious mental processes and creates the belief that the outcomes that we observe and produce are the result of our conscious will (Libet, 2004; Prinz, 2003; Wegner, 2002).

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