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A Matter of Matching: How Goals and Primes Affect Self-Agency Experiences

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The sense of self-agency is a pervasive experience that people infer from their actions and the outcomes they produce. Recent research suggests that self-agency inferences arise from an explicit goal-directed process as well as an implicit outcome-priming process. Three experiments examined potential differences between these 2 processes. Participants had the goal to produce an outcome or were primed with the outcome. Next, they performed an action in an agency-ambiguous situation, followed by an outcome that matched or mismatched the goal or prime, and indicated experienced self-agency over the action-outcome. Results showed that goals reduce self-agency over mismatching outcomes. However, outcome-primes did not affect self-agency over mismatching outcomes but even enhanced self-agency over mismatching proximate outcomes. Goals and outcome-primes equally enhanced self-agency for matches. Our findings provide novel evidence that self-agency experiences result from 2 distinct inferential routes and that goals and primes differentially affect the perception of our own behavior.

Keywords: inferences of self-agency, goal-directed control processes, outcome priming, matching

Humans are able to become aware of themselves as being the cause of the actions they perform and the outcomes they produce. This experience of self-agency or authorship appears quite natural to most people. A basic sense of self-agency over behavior seems to be established already in early infancy and is further developed during the first years of our lives when people start distinguishing between the outcomes of their own actions and outcomes caused by other agents (e.g., Brownell & Carriger, 1990; Decety & Chaminade, 2003; Piaget, 1954; Rochat & Striano, 2000). Thus, the experience of self-agency is socially well shared and essential to human self-perception and social interaction.

Because the experience of self-agency appears so natural to us, we often think we know quite well whether or not we are the cause of a certain outcome. However, the establishment of the experience of self-agency is less straightforward than it may seem. In everyday life, people often perform actions that have multiple outcomes. For example, one may hold one's hand up at Broadway, and a taxi and bus pull over and stop. One says something silly in a meeting, and some colleagues start laughing while others frown. Moreover, we often act in a social context where others may also cause particular outcomes. For example, the smile on others' faces might also be the result of the new haircut of a colleague that just entered the room. Whether engaging in simple motor movements or social interactions then, it is not always clear which outcome occurs and what or who caused the outcome. How then, does the mind produce the experience of self-agency in contexts where several outcomes may occur and the cause of outcomes is ambiguous?

According to the theory of apparent mental causation (Wegner, 2002; Wegner & Wheatley, 1999), people infer self-agency based on mental previews (i.e., priority principle), resulting in the experience of self-agency to the extent that an outcome matches this preview (i.e., consistency principle). In line with this notion, research has shown that self-agency experiences often result from inferences that we draw from our purpose to engage in behavior. That is, if one had the explicit goal of bringing about a certain outcome and then that outcome actually occurred, one must have caused it. Interestingly, recent research indicates that self-agency experiences also arise in everyday social interactions that are guided by the environment and that occur without much conscious intent and thought. Specifically, observing outcomes that are implicitly preactivated or primed in our minds before action performance also provides the feeling that we caused the behavioral outcome once it actually occurs (e.g., Aarts, Custers, & Wegner, 2005; Sato, 2009; van der Weiden, Aarts, & Ruys, 2010; Wegner & Wheatley, 1999). This research suggests that experiences of self-agency result from cognitive inferences that are based on representations of outcomes that serve as mental previews, irre-

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spective of whether these representations are preactivated by an explicit goal or an implicit prime.

The fact that the experience of self-agency follows from explicit goal-directed as well as implicit priming effects does not necessarily suggest however, that goals and primes affect authorship processing in the same way. Based on the notion that goals evoke specific control processes dealing with monitoring and feedback processing of achieving a specific desired outcome (e.g., Carver & Scheier, 1998; Custers & Aarts, 2007), we propose here that goals and outcome-primes affect experiences of self-agency through different mechanisms. In particular, we argue that experiences of self-agency are influenced by goals through an inferential process in which attention is focused on one specific outcome (i.e., the intended outcome) and which incorporates both matching and mismatching outcome information. Thus, goals are central to agency as part of the process underlying goal achievement. However, outcome priming effects on experienced self-agency depend on an inferential process that is more open to associative processing of related outcome information and that incorporates only matching outcome information. As such, the experience of self-agency resulting from goals and outcome primes is a matter of matching. We report three experiments that examined these novel and intriguing ideas.

Inferences in Experienced Self-Agency

The actions we conduct and the outcomes they produce are often accompanied by feelings of self-causation. It is I who is doing it. This sense of self-agency is central to research on volitional behavior (Haggard, 2008) and the role of the self in controlling behavior (Baumeister, Schmeichel, & Vohs, 2007). In social psychological models of goal-directed behavior, the experience of self-agency is often seen as a product of a comparison between intended and actual outcomes (e.g., Bandura, 1986; Carver & Scheier, 1998; Deci & Ryan, 1985; Weiner, 1985). According to these models, the experience of self-agency readily and fluently emerges when the perception of an outcome corresponds with the outcome one had in mind and intended to attain by performing an action, even in the absence of action planning and execution (Moore, Wegner, & Haggard, 2009; C. Preston & Newport, 2010; Wegner, Sparrow, & Winerman, 2004). If the observed outcome does not match the goal, the sense of agency is reduced. Hence, inferences of self-agency follow from a monitoring and feedback process that is instigated by a goal-directed state of mind.

However, one may question whether feelings of self-agency only originate from goal-directed processes, especially since much of our behavior and experiences are influenced by cues in our environment (Bargh & Chartrand, 1999). Interestingly, as self-agency experiences rely on a match between previewed 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. In such cases, the mind can produce a heightened sense of authorship for its owner (Wegner, 2002). 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 corresponding outcome. This is why people can experience a sense of self-agency not only over goal-directed behavior but also over behavior that is influenced by cues in our social environment, outside of conscious awareness.

In a study testing this idea (Aarts et al., 2005), participants had to stop the rapid movement of a square traversing a rectangular path consisting of eight tiles (see Figure 1 for a visualization of the task). Thus, stopping the movement could cause the square to stop on one out of eight positions. The computer also moved another square over the rectangular path that would also stop on one out of eight positions. After participants pressed the stop key, they were presented with only one of the squares' stop location. This stop location thus represented the stop location of either their own or the computer's square, rendering the cause of the outcome ambiguous. As a measure of experienced self-agency, participants indicated the extent to which they felt that they caused their square to stop at the presented location. Crucially, half of the participants were given the explicit goal to stop their square at a specific location beforehand, whereas the other half of the participants were briefly primed with that location just before they stopped the movement and saw the presented stop at the corresponding location. Results showed that both the goal and outcome prime enhanced the sense of self-agency compared to a baseline (no preactivation of outcome) condition. The priming effects are robust and have been replicated across different tasks (Aarts, 2007; Ruys

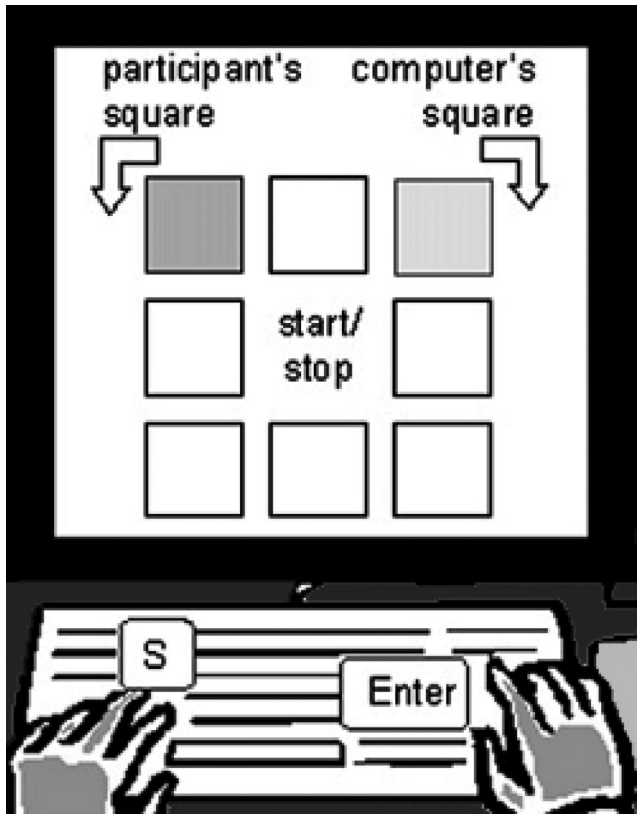

Figure 1. Visualization of the wheel of fortune task, showing how the squares move in an opposite direction. Adapted from "On the Inference of Personal Authorship: Enhancing Experienced Agency by Priming Effect Information," by H. Aarts, R. Custers, and D. M. Wegner, 2005, *Consciousness and Cognition, 14,* p. 444. Copyright 2005 by Elsevier. Adapted with permission.

& Aarts, 2012; van der Weiden et al., 2010; Wegner & Wheatley, 1999) and cultures (Aarts, Oikawa, & Oikawa, 2010). Importantly, these findings suggest that people experience self-agency when the outcome of our action matches the outcome that they have in mind, irrespective of the source of the preactivated outcome representation (an explicit goal or implicit prime).

Goals Versus Outcome Primes and Inferences of Self-Agency

Although both goals and outcome primes enhance self-agency in a similar way, there are also differences between goals and primes (see Custers & Aarts, 2005; Fishbach & Ferguson, 2007; Förster, Liberman, & Friedman, 2007). These differences may play an important role in the way people arrive at self-agency experiences. One important difference between goals and primes pertains to the way they cause people to attend to and control their behavior.

When people have a goal that they aim to achieve, their attention and behavior is directed toward that specific goal (e.g., Aarts, 2012; Carver & Scheier, 1998; Dijksterhuis & Aarts, 2010; Powers, 1973; Vallacher & Wegner, 1987). Accordingly, goals have distinctive effects on the processes that render goal achievement more effective. First, goals provide a current reference point that focuses people's attention on the specific intended outcome and shields the focal goal from potential interference deriving from other possible associated outcomes. Second, goals cause people to monitor progress toward goal achievement. Thus, it is not only important to know when the outcome of an action matches the specific goal but also when the outcome mismatches the goal as, by detecting discrepancies between an action-outcome and one's goal, people can regulate or reappraise their goals in a different way (e.g., Bargh & Williams, 2007). Therefore, not only matches but also mismatches are likely to influence experienced self-agency over goal-directed action-outcomes. Yet, whereas matches typically enhance experienced self-agency, mismatches lead to a decrease in experienced self-agency. Such a decrease in agency is likely because people generally expect their actions to be successful in producing intended outcomes, and the causal ambiguity in the situation at hand allows them to ascribe authorship to other external agents (e.g., Custers, Aarts, Oikawa, & Elliot, 2009; J. L. Preston, Ritter, & Wegner, 2011; Shepperd, Malone, & Sweeny, 2008).

However, outcome primes operate in a different way. Whereas outcome primes render the representation of the outcome accessible in mind and hence provide a glimpse into how future actions may transpire, in principle they lack the specific properties pertaining to the control of goals (Aarts, 2012). Specifically, outcome primes do not encourage people to focus attention on the specific outcome at hand and to shield the outcome representation from other possible associated outcomes, as there is no need to control behavior toward achieving that specific outcome. Moreover, outcome primes do not cause people to monitor goal progress like goals do. Accordingly, mismatching outcomes are less informative or diagnostic to rely on when establishing a sense of agency. As previous work on priming and self-agency suggests (e.g., Aarts et al., 2005; Wegner et al., 2004), the experience of self-agency mainly depends on inferring whether there is a match between the outcome-prime and the actual outcome or not.

Interestingly, this matching process underlying outcome priming effects on experienced self-agency may be less specific than for goals. An important reason for this is because priming a specific outcome may spread activation to outcomes that are associated to the primed outcome (e.g., Collins & Loftus, 1975; McNamara, Ratcliff, & McKoon, 1984; Newell, Sheppard, Edelman, & Shapiro, 2005). For example, priming the concept of "apple" may also activate the concept of "pear," as these concepts belong to the same category (fruit). Also, priming a chess player with "rook" (position A1) may activate a representation of "knight" (position B1) rather than a representation of "king" (position E1), simply because the rook and the knight are located spatially relatively close to each other. In other words, outcome primes activate representations of other outcomes that are (categorically or spatially) associated with the primed outcome due to the lack of focused attention on the outcome. Thus, a match may be detected between the activated representation of an outcome and the actual outcome to the extent that the actual outcome is associated with the outcome prime, thereby enhancing experienced self-agency over outcomes that in actuality mismatch the outcome prime.

In sum, although previous research suggests that goals and outcome-primes affect experienced self-agency through one single cognitive inference process, we propose that different mechanisms may become apparent when actual outcomes mismatch goals or outcome-primes. Specifically, when people have a specific goal in mind, attention is directed to the intended outcome and progress toward goal attainment is monitored such that matches and mismatches with the specific goal increase and decrease self-agency experiences, respectively. Yet, when primed with an outcome, mismatching outcomes are less diagnostic, and self-agency is merely based on a match between the primed and actual outcome. Because activation may spread to outcomes that are relatively close to the primed outcome, self-agency over associated outcomes may also be enhanced when primed and actual outcome do not match (i.e., when there is a partial overlap between the primed and actual outcome).

The Present Research

To test these hypotheses we conducted three experiments employing a multiple outcome task in which self-causation was ambiguous. Specifically, participants repeatedly performed an action that was directly followed by one outcome out of a set of possible outcomes that could also have been caused by the computer. After observing the outcome, participants indicated experienced self-agency over outcomes that either matched or mismatched with preactivated outcomes resulting from goals or priming. In all experiments, participants were exposed to a goal condition and an outcome priming condition. In the goal condition, they were explicitly instructed to cause a specific outcome, prior to their action and observing a (matching or mismatching) outcome. In the outcome priming condition, the observed (matching or mismatching) outcome was primed just before their action. To prevent participants from forming explicit goals to achieve the outcome in the outcome priming condition, outcome primes were presented for a very brief time (17 ms), thereby reducing the likelihood of entering conscious awareness.

In Experiment 1, we tested the hypothesis that self-agency will not be affected by mismatching outcome primes, while self-agency will be affected when an outcome mismatches a goal. More specifically, we hypothesize that whereas outcome priming and goals are both expected to enhance experienced self-agency for matches compared to mismatches, only goals are expected to decrease the sense of agency over mismatches. We conducted two experiments that test this prediction in a task where actual outcomes spatially (Experiment 1) or categorically (Experiment 2) match or mismatch with either a goal or an outcome-prime.

In Experiment 3, we examined the different routes to experienced self-agency more closely by systematically varying the degree to which observed outcomes are associated with a goal or an outcome-prime (i.e., the discrepancy between the observed outcomes and the goals or primed outcomes). Importantly, we propose that goals and primes differentially affect experiences of self-agency over mismatching outcomes. Because goals are supposed to encourage people to focus on the specific intended outcome represented by the goal, we expected a mismatch between the actual outcome and the goal to decrease the sense of agency, irrespective of the distance or discrepancy between the outcome and the goal. However, we expected that outcome priming enhances experiences of self-agency over mismatching outcomes to the extent that these outcomes are associated to the primed outcome and are hence to some extent perceived to match the primed outcome. As a result, experienced self-agency gradually decreases and approaches baseline (no priming) levels of self-agency as the distance, and thus the associative strength, between the outcome prime and the actual outcome decreases.

Experiment 1

Method

Participants and design. Forty undergraduates completed this experiment in return for course credit or a small payment. The experiment had a 2 (matching: mismatch versus match) by 2 (type of preactivation: goal vs. prime) within-participants design.

Experimental task and procedure. In this experiment, we used the wheel of fortune paradigm (see Aarts et al., 2005). Participants worked individually on the task. They learned that the task was designed to examine people's experiences of behavior and how these experiences come and go. In the task, participants and the computer each moved a single gray square at the same speed in opposite directions on a rectangular path consisting of eight white tiles. The two squares moved in alternating motion (that is, the squares were displayed one after the other). Squares were displayed for 50 ms on each position. Thus, one lap was 800 ms (50 ms * 8 positions * 2 squares). After four or five laps, participants received a STOP cue and had to stop the movement immediately by pressing the Enter key. As soon as the STOP cue appeared, participants were no longer able to see or follow the movement of the squares, but they were told that the squares would continue moving in the background and that the stop location of their square depended on the timing of their action of pressing the STOP key. One hundred ms after participants pressed the STOP key, one of the eight tiles turned black. This black tile was presented for 1 s and represented the location of either the participants' square or the computer's square at the time they pressed stop. Importantly, the participant or computer could have caused the square to stop at the presented location, rendering the cause of the outcome ambiguous (cf. Wegner & Wheatley, 1999). In actuality, the stop location was always determined by the computer, and hence, actual control was absent. The stopped location was presented eight times on each of the eight tiles of the path; twice for each of the four (goal mismatch, goal match, prime mismatch, and prime match) within-participants conditions. The experimental task thus consisted of 64 trials.

Each trial started with a warning signal (i.e., "pay attention") that was presented for 3 s, followed by a START cue in the middle of the rectangular path. Upon pressing the S key in reaction to this start cue, the squares would start moving and the trial would take place as described above.

All of the participants were presented with 32 goal trials and 32 prime trials in separate blocks, and the order of blocks was counterbalanced between subjects. Within a block, trials were randomly presented. In between the blocks, participants received the relevant instructions concerning the goal or prime trials to make sure they knew what they had to do.

Outcome priming. In prime trials, participants were primed with outcome information just (67 ms) before they had to stop the moving squares. In 16 of these trials, a black square was flashed for 17 ms on the position on which the square would eventually stop. In another 16 trials, participants were primed with mismatching outcome information, that is, a black square was flashed for 17 ms on a (randomly selected) position three or four tiles away from where the square would stop.

Goal instruction. In goal trials, participants were given the goal to stop their square at a particular location. Specifically, participants were presented with the location where they had to stop their square during the 3 s in which also the warning signal was presented. In 16 trials, the actual outcome matched this location, and in another 16 trials, the actual outcome mismatched. During the 17 ms in which an outcome was primed in the prime trials, the rectangular path consisting of eight white squares was presented instead. Hence, goal and prime trials were identical in duration.

Measure of experienced self-agency. After each trial, participants indicated the extent to which they felt having caused the square to stop on the presented location. This measure of experienced self-agency was responded to on a 10-point answer scale (not at all me [0]–absolutely me [9]).

Measurement of response time. The computer also measured participants' time to push the Enter button in response to the STOP cue. We measured response times to calculate potential causation. That is, the last presentation of the participant's square was always four locations farther than the goal or prime location (half a lap). Hence, the time from the onset of the last location of the participants' square to the onset of a matching stop location was 800 ms/2 = 400 ms. For mismatching trials, the time from the onset of the last location of the participants' square to the onset of the stop location was 800 ms for a full mismatch (1 lap) and 700 ms and 900 ms for mismatches one tile before and one tile after the full mismatch, respectively. Accordingly, the time between the STOP cue and the onset of the presented stop location was 283 ms for matches and 583, 683, or 783 for mismatches (i.e., 400 ms, and 700, 800, or 900 ms, minus 50 ms from the last presentation of the participant's square, and minus 67 ms for the priming event). Thus,

the primary response time required for the participants' square to stop exactly on the location indicated by the black square at half of its presentation time was 308, 608, 708, or 808 ms (283, 583, 683, or 783 ms plus 25 ms).

Debriefing. In all of the reported studies, participants were specifically asked whether they had seen flashes during the task without the goal instructions (that is, the outcome prime trials) and, if so, whether they could identify the content of the flashes. In line with previous work (Aarts, Custers, & Marien, 2009; van der Weiden et al., 2010; van der Weiden, Aarts, & Ruys, 2011), debriefing showed that none of the participants had seen the outcome primes. Furthermore, none of them realized the true nature of the study.

Results

First, in this and the following experiments, the order condition (goal first or prime first) did not show a main or interaction effect with the other factors in the design. Hence, the order condition was further dropped from the analyses.

Average experienced self-agency over matching and mismatching outcomes was computed separately for the goal trials and prime trials and subjected to a 2 (matching: mismatch vs. match) × 2 (type of preactivation: goal vs. prime) repeated measures analysis of variance (ANOVA). This analysis revealed a main effect of matching, $F(1, 39) = 40.59$, $p < .001$, $\eta_p^2 = .51$, such that experienced agency was higher over matching than over mismatching outcomes. Furthermore, the expected significant interaction effect between matching and type of preactivation emerged, $F(1, 39) = 7.43$, $p = .01$, $\eta_p^2 = .16$. There was no main effect of type of preactivation, $F(1, 39) = 1.79$, $p = .19$, $\eta_p^2 = .04$.

To gain further insight in the two-way interaction effect and to test our specific predictions, we conducted planned contrast analyses. These analyses showed that experienced self-agency over matching outcomes did not differ between the goal and prime conditions, $F(1, 39) = 1.82$, $p = .19$, $\eta_p^2 = .04$. However, experienced self-agency over mismatching outcomes was lower in the goal condition than in the prime condition, $F(1, 39) = 6.99$, $p = .01$, $\eta_p^2 = .15$. Also, experienced self-agency was higher over matching than over mismatching outcomes in both the priming, $F(1, 39) = 24.78$, $p < .001$, $\eta_p^2 = .39$, and the goal condition, $F(1, 39) = 40.31$, $p < .001$, $\eta_p^2 = .51$. The means for each cell in the design are presented in Figure 2.

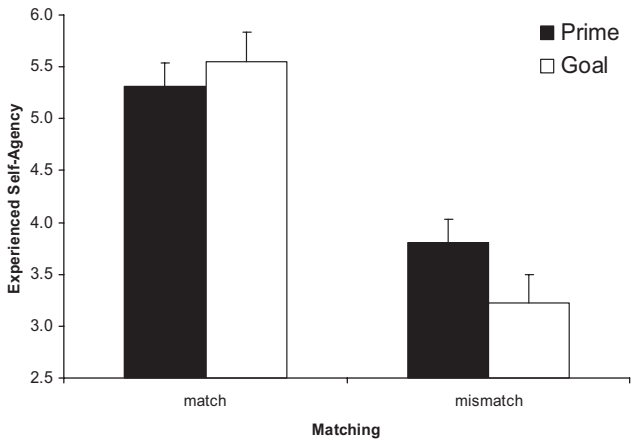

Figure 2. Experienced self-agency over outcomes that spatially matched or mismatched either a goal or an outcome-prime in Experiment 1. Error bars represent standard errors of the means.

Potential relation between timing of stop action and self-agency experiences. In the present experimental set-up participants could not follow their square from the moment they had to press the stop key. Hence, they never were sure whether the presented stop location was the location where their own square had stopped. However, participants might have followed their square internally (in mind) and, based on the timing of their action (pressing the STOP key), they might have made a prediction of their square's stop location and inferred agency based on this prediction. That is, the timing of pressing the STOP key may be a cue to agency experiences, and such a relation may differ for goals and primes and for matches and mismatches. To examine this possibility, we ran additional tests.

We first examined whether the distance between participants' square's stop location, given the timing of their stop action and the presented stop location (the degree of potential causation), correlated with experienced self-agency for matching and mismatching trials and prime and goal trials, separately. In line with earlier work (Aarts et al., 2005), we therefore calculated the absolute difference between the STOP key response time and the time required to stop exactly on the position of the presented stop location at half of its presentation time (i.e., 308 ms for matches; 708 ms for full mismatches, and 608 ms and 808 ms for mismatches one tile before and one tile after the full mismatch, respectively). This way, for each trial we have an estimate of how close participants had stopped to the presented position. The smaller the absolute difference, the more likely they actually could have caused the square to stop on the presented position. The correlation analyses showed that there was no relation between experienced self-agency and how close the participants' square stopped to the presented location in any of the conditions (goal match, $r = -.04$, $p = .79$; goal mismatch, $r = -.10$, $p = .56$; prime match, $r = -.16$, $p = .32$; prime mismatch, $r = .03$, $p = .87$).

Next, to examine whether the potential causation measure may explain the earlier reported pattern of results on self-agency as a function of preactivation (goal vs. prime) and (mis)matching, we included potential causation as a covariate in the original ANOVA. Because the covariate takes on a different value for each of the within-participants conditions, we first converted our data from wide format (i.e., with one row per subject) to long format (i.e., with one row per subject and per matching and type of preactivation condition) before we conducted the required analyses. The analysis of covariance (ANCOVA) with subject as repeated factor and matching and type of preactivation as fixed factors yielded the same pattern of results as before: preactivation ($F < 1$), matching, $F(1, 133) = 7.22$, $p = .01$, $r = .23$, and the interaction between the two, $F(1, 117) = 4.14$, $p = .04$, $r = .18$. The covariate potential causation did not affect experienced self-agency ($F < 1$). Together, then, these results show that, at least in the present experimental set-up, experienced self-agency does not rely on the estimated or predicted outcomes following from action but rather result from matches and mismatches between observed outcomes and the preview of that outcome as activated by goals and primes.

Discussion

In line with predictions, self-agency did not differ between goals and outcome primes when there was a match. Furthermore, experienced self-agency over outcomes that mismatch a goal was lower than experienced self-agency over outcomes that mismatch an outcome prime. Importantly, and in light of the findings reported in the footnote[1] (showing no differences in experienced self-agency between baseline and mismatching outcome primes), it seems that self-agency is not affected by mismatching outcome primes and that experienced self-agency decreases below baseline when an outcome mismatches a goal. This supports our thesis that in case of outcome priming, the inferential process only incorporates matching information and that experienced self-agency is a function of activation of the matching outcome representation.

These results support our line of reasoning that experiences of self-agency over outcomes that mismatch goals may decrease because goals instigate processes that are highly relevant for agency experiences since they cause people to attend to and monitor progress toward goal achievement and to take both matches and mismatches into account to arrive at a sense of agency. Outcome primes, however, only render the representation of the outcome accessible and do not necessarily launch a monitor and feedback process that checks whether the outcome was successfully accomplished. In other words, only when the preactivation of the outcome is accompanied by a goal-directed mode of processing, people generally check whether their actions are congruent or incongruent with the outcome they had in mind.

It is important to note that beside differences in goal-directed control processes, in the present study, goals and primes also differed in presentation time. That is, goals were induced consciously for 3 s and outcomes were primed for 17 ms (likely too short for conscious processing). Whereas we presented outcome primes briefly to prevent subjects from forming goals due to the within-participants design (i.e., half of the participants formed goals in previous trials), differential effects of goals and outcome primes may be attributable to differences in conscious access or salience. However, there is research suggesting that conscious accessibility does not modulate outcome priming effects on self-agency per se. In one study (Wegner et al., 2004) participants were *supraliminally* primed with matching, mismatching, or no outcomes (baseline). Results showed that self-agency only increased over matching outcomes but that self-agency did not differ between the mismatch and baseline conditions. Furthermore, another study directly compared effects of subliminally and supraliminally presented outcome primes in a between-subjects design and showed that both types of primes enhance experienced self-agency to the same extent when the actual outcome matches these primes (Aarts et al., 2005). In line with the present results, these findings suggest that the inference process only incorporates matching information regardless of whether the preactivated outcome information is accessible to consciousness or not.

Still, while consciousness may not play a role in explaining the effects of goals versus primes, the difference in outcome presentation time for goals and primes also creates differences in the possibility of strategic use of knowledge in judgment-making. Specifically, in the goal (compared to prime) condition, participants could have more strongly followed the strategy to attribute agency to themselves when an outcome matches and to not attribute agency to themselves when an outcome mismatches. However, if this would be the case, one would expect that participants experience more self-agency over matching outcomes in the goal condition than in the prime condition. This is not what the data portray. In fact, matching goals and primes enhanced experienced self-agency to the same extent.

In sum, in the present study, consciousness does not seem to explain the differential effects of goals and outcome primes on experiences of self-agency over matching and mismatching outcomes. Furthermore, although the goals were more salient than the outcome primes, the observation that self-agency was affected to the same extent when outcomes matched goals and primes suggests that goals are not necessarily more relevant or influential than primes when it comes to inferences of self-agency. Only when goals mismatched with observed outcomes did they differ from primes in shaping experiences of self-agency.

Experiment 2

Experiment 2 served two main purposes. First, we aimed to conceptually replicate the findings of Experiment 1 in a different task in which actions produced semantic outcomes (i.e., object words) rather than spatial outcomes.

Second, we aimed to examine whether people rely on outcome discrepancy alone to infer a sense of agency over outcomes that do not match their goal by eliminating temporal distance as possible discrepancy information. It is important to note that the findings of Experiment 1 are based on the rationale that goals (vs. primes) decrease self-agency for mismatches due to the mere discrepancy of the outcome representation activated by the goal and the observed outcome. However, the rotating square task of Experiment 1 allows participants to follow the movement and location of their square internally (in mind). Hence, they could predict where their square would stop upon pressing the stop key and base self-agency on the temporal distance between the predicted outcome and actual outcome. Although the data of Experiment 1 suggest that such action prediction process did not contribute to the self-agency effects, previous research indicates that temporal distance can serve as discrepancy information in modulating the sense of agency in simple operant action performance (Spengler, von Cramon, & Brass, 2009). Hence, it would be more compelling to demonstrate that mismatches affect self-agency differently for goals than for outcome primes by eliminating the temporal aspect in the experimental task setup.

[1] In an additional experiment with a different sample of undergraduates ($n = 22$), we employed the same rotating square task to test outcome priming effects of matches, mismatches, and no outcome primes (baseline) on experienced self-agency. ANOVA, with matching (no-prime vs. mismatch prime vs. match prime) as a within subjects variable, yielded a significant effect of matching, $F(2, 20) = 5.74$, $p = .01$, $\eta_p^2 = .37$. Planned contrast analyses revealed that agency ratings were higher when a matching outcome was primed ($M = 5.47$, $SD = 0.99$) than when a mismatching outcome was primed ($M = 4.61$, $SD = 1.39$), $F(1, 21) = 4.67$, $p = .04$, $\eta_p^2 = .18$, and when no outcome was primed ($M = 4.87$, $SD = 1.42$), $F(1, 21) = 4.62$, $p = .04$, $\eta_p^2 = .18$. Agency did not differ between the no-prime baseline and mismatch prime conditions ($F < 1$). In line with our hypothesis, these findings indicate that outcome priming effects on inferences of experienced self-agency rely only on matches and not on mismatches between primed and actual outcomes.

For this purpose, we used a task where participants have to stop a rapidly presented sequence of letter strings that ostensibly masks the alternation of four words (e.g., glass or soap), by pressing a key. In actuality, no words are presented. Participants then observe that the sequence stops on one of the four words (cf. a gamble machine, in which one stops rapidly rolling symbols by pushing a button) and are told that they or the computer could have determined the stopped word. Participants are either primed with or receive the goal to stop at a designated word (e.g., glass) at a specific moment in time (van der Weiden et al., 2010). The stopped word matches (e.g., glass) or mismatches (e.g., soap) with the prime or the goal. Thus, in this task, participants cannot predict the outcome of their action based on temporal estimates, and hence, agency experiences emerge as a result of mere discrepancies.

Method

Participants and design. Sixty-four undergraduates completed the experiment in return for course credit or a small payment. The experiment had a 2 (matching: mismatch vs. match) × 2 (type of preactivation: goal vs. prime) within-subjects design.

Experimental task and procedure. The self-agency task was adapted from earlier research on priming and agency (Aarts et al., 2009; van der Weiden et al., 2010). Participants were told that this task was designed to examine experiences of self-causation when causation is ambiguous. For this purpose, they learned to stop a sequence of letter strings, rapidly presented in the middle of the computer screen, by immediately pressing a designated key upon seeing the stop cue (see Figure 3). Each trial started with a warning signal (i.e., "pay attention" presented for 3,000 ms.), 500 ms later followed by a start cue. After pressing the designated key, the alternation of letter strings began, and at some point, the stop-cue was presented. In each trial, 22 letter strings were presented for 170 ms with a 30-ms interval between two successive strings. One hundred ms after each stop, one of four object words (glass, soap, fork, mint) would appear in the middle of the screen for 1 s. Participants were told that the four object words were briefly presented in between the different strings of capital letters (e.g., PAEXJD), so that they would not be able to see the object words. Furthermore, they learned that the presented object could also be determined by the computer. Participants were thus led to believe that either they themselves or the computer could be the cause of the stopped word. In actuality, the words were not presented, and the computer always determined the stopped word.

Each of the four object words was presented as an outcome eight times—twice in each condition of the 2 (matching: mismatch vs. match) × 2 (type of preactivation: goal vs. prime) design. The experimental task thus consisted of 32 trials. As in Experiment 1, type of preactivation (goal vs. prime) was manipulated in two blocks, and the order in which participants received the blocks was counterbalanced between participants.

Outcome priming. In eight of the 16 prime trials, the name of the matching object word (in capital letters) was briefly primed within the presentation stream of letter strings for 30 ms (for a subliminality check of this procedure, see Aarts et al., 2009). In the other eight trials, the name of a mismatching object word (one of the other three objects was randomly selected) was presented. Each letter string was presented for 170 ms, and between two successive strings there was a 30-ms interval. As a default, a random letter string containing six characters was presented during this interval. In the prime trials, an object word was presented on every third 30-ms interval for seven intervals in a row. Thus, the letter strings served as pre- and postmasks for the primes, and the time between primes was 570 ms. The time between the last prime and the STOP-cue was also 570 ms.

Goal instruction. In the 16 goal trials, participants were instructed before each trial to stop on a specific object word. This goal either matched (same object; in eight trials) or mismatched (randomly selected other object; in the other eight trials) the actual action-outcome. The goal instruction was presented at the begin-

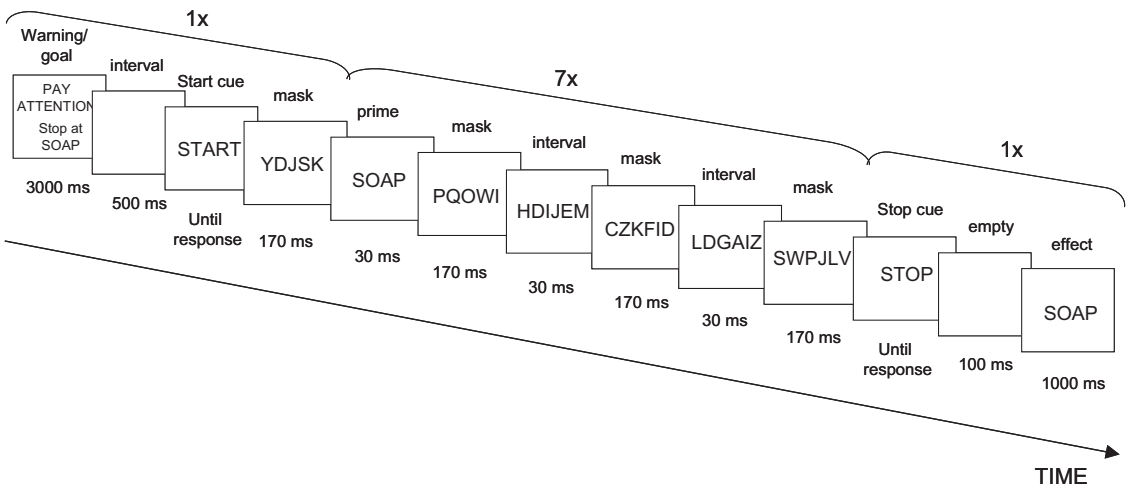

Figure 3. Schematic example of a matching goal trial of the action-outcome task of Experiment 2. Adapted from "Reflecting on the Action or Its Outcome: Behavior Representation Level Modulates High Level Outcome Priming Effects on Self-Agency Experiences," by A. van der Weiden, H. Aarts, and K. I. Ruys, 2010, *Consciousness and Cognition, 20,* p. 1868. Copyright 2011 by Elsevier. Adapted with permission.

ning of each trial during the 3 s at which the warning signal was also presented.

Measure of self-agency. After each presented product, participants indicated to what extent they felt that they had stopped the product. This agency experience was measured on a 10-point scale (not at all me [0]–absolutely me [9]).

Results

Average experienced self-agency ratings were subjected to a 2 (priming: mismatch vs. match) × 2 (type of preactivation: goal vs. prime) repeated-measures ANOVA. This analysis revealed a main effect of matching, $F(1, 63) = 37.93$, $p < .001$, $\eta_p^2 = .38$, such that experienced self-agency was higher over matching outcomes than over mismatching outcomes in both the goal condition, $F(1, 63) = 31.71$, $p < .001$, $\eta_p^2 = .34$, and the prime condition, $F(1, 63) = 4.78$, $p = .03$, $\eta_p^2 = .07$. Also, the expected interaction of matching and goal-directedness emerged, $F(1, 63) = 15.70$, $p < .001$, $\eta_p^2 = .20$. There was no main effect of type of preactivation, $F(1, 63) = 1.21$, $p = .28$, $\eta_p^2 = .02$.

To gain further insight in this interaction and to test our specific predictions, we conducted planned contrast analyses. These analyses showed that experienced self-agency over matching outcomes did not differ between the goal and prime conditions ($F < 1$). However, as expected, experienced self-agency over mismatching outcomes was lower in the goal condition than in the prime condition, $F(1, 63) = 7.21$, $p = .01$, $\eta_p^2 = .10$. The means of the match and mismatch trials in both the goal and prime conditions are presented in Figure 4.

Discussion

In line with Experiment 1 and previous research on experienced self-agency over matching outcomes, the results showed that experienced self-agency was enhanced by both goals and outcome-primes when the outcome matched. Importantly, and consistent with Experiment 1, results further showed that experienced self-agency was lower when outcomes mismatched a goal than when outcomes mismatched an outcome-prime. These effects occurred even though the temporal aspect of the discrepancy information was eliminated. This indicates that matches and mismatches only relied on the overlap between the representation of the preactivated outcome and the observed outcome. These results thus conceptually replicate but also extend the findings of Experiments 1, by showing that outcomes that mismatch on a semantic level also affect self-agency differently for goals and outcome primes.

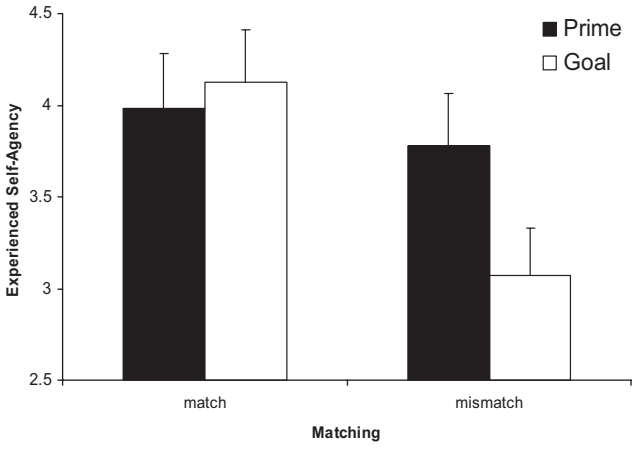

Figure 4. Experienced self-agency over outcomes that semantically matched or mismatched either a goal or an outcome-prime in Experiment 2. Error bars represent standard errors of the means.

Experiment 3

Thus far, we showed that mismatching outcomes have a differential impact on experienced self-agency, depending on whether these outcomes mismatch with a goal or an outcome prime. Experiment 3 aimed to push this idea one step further by testing whether experienced self-agency over mismatching outcomes decreases in a different manner for goals and primes as a function of varying levels of discrepancy between observed and preactivated outcomes. That is, experienced self-agency depends on the *extent* to which an activated outcome representation matches the actual outcome (i.e., consistency principle). As we outlined in the introduction, we hypothesize that as the actual outcome mismatches to a greater extent, experienced self-agency decreases in a different manner for goals than for outcome primes.

Specifically, based on the notion that goals evoke control processes dealing with attention to and monitoring and feedback processing of the specific desired outcome, we hypothesized that in case people have a specific goal in mind, experienced self-agency decreases immediately, regardless of the degree of mismatch. That is, any mismatch lowers the sense of agency. However, when primed with a specific outcome as part of other possible outcomes, activation may spread to the other outcomes and may thus result in a less specific inference process. Hence, a match may be detected between the activated representation of an outcome and the actual outcome to the extent that the actual outcome is associated with the outcome prime, thereby enhancing experienced self-agency over outcomes that in actuality mismatch the outcome prime. Therefore, we hypothesized that when there is no goal but only an accessible representation of the outcome due to priming, experienced self-agency will decrease more gradually and approach baseline levels of agency as the association between the outcome and the outcome-prime decreases.

To test this idea, we used an adapted version of the rotating square task and systematically varied the spatial distance between the action-outcomes and the goals and primes. Furthermore, as in Experiment 2, we eliminated the temporal aspect of the task by letting the squares move over the eight tiles in a random order instead of clockwise and counterclockwise. This way, goal and priming effects on experienced agency over matches and mismatches are solely based on the overlap between the representation of the preactivated outcome and the observed outcomes.

Method

Participants and design. Forty-two undergraduates completed this experiment in return for course credit or a small payment. The experiment had a 5 (matching: match, 1 tile apart, 2 tiles apart, 3 tiles apart, 4 tiles apart) × 2 (type of preactivation: goal vs. prime) within-participants design.

Experimental task and procedure. The task and procedure employed in this experiment were similar to those of Experiment

1, with two major modifications. As we just mentioned, we changed the movement of the squares, such that they did not move clockwise and counterclockwise anymore, but in a random order. Furthermore, we varied the degree to which the outcome would mismatch the goals or primes. That is, instead of always randomly presenting the mismatch at three or four tiles away from the goal or outcome-prime, we now systematically varied the distance between the outcome and the goal or prime. Since there are eight tiles within the rectangular path, this resulted in five distances: no distance (match), one location, two locations, three locations, and four locations (opposite).

Each of the matching conditions was presented once at each of the eight locations for the goal condition and once at each of the eight locations in the prime condition, resulting in 80 trials. Again, type of preactivation was manipulated between blocks, and the order in which they were presented was counterbalanced between participants.

Results

Average scores of self-agency were subjected to a repeated-measures ANOVA with matching and type of preactivation as within-subjects factors. As expected, a main effect of matching appeared, $F(4, 38) = 12.86$, $p < .001$, $\eta_p^2 = .58$. Participants experienced more agency over outcomes that matched compared to outcomes that mismatched by one tile, two tiles, three tiles, or four tiles. Furthermore, there was a main effect of type of preactivation, $F(1, 41) = 4.80$, $p = .03$, $\eta_p^2 = .11$. Experienced agency was lower in the goal condition compared to the prime condition. However, this effect was qualified by the expected interaction of type of preactivation and matching, $F(4, 38) = 4.84$, $p = .003$, $\eta_p^2 = .34$. The means for each cell in the design are presented in Figure 5.

As can be seen in this figure, experienced self-agency is lower when outcomes mismatch a goal than when outcomes mismatch an outcome prime. Furthermore, experienced self-agency seems to decrease in an immediate fashion in the goal condition, whereas experienced self-agency seems to decrease in a more linear fashion in the prime condition. To further the understanding of this pattern of results and to test our specific hypotheses, we conducted follow-up analyses.

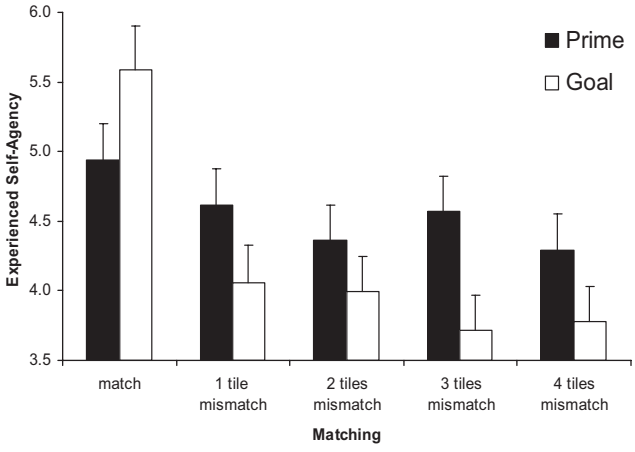

Figure 5. Experienced self-agency over outcomes that mismatched to an increasing degree with either a goal or an outcome-prime in Experiment 3. Error bars represent standard errors of the means.

First of all, to corroborate the findings of Experiments 1 and 2, we analyzed the effect of type of outcome activation for matching and maximally mismatching (four tiles discrepancy) outcomes. This analysis revealed a main effect of matching, $F(1, 41) = 34.91$, $p < .001$, $\eta_p^2 = .46$, and no effect of type of preactivation ($F < 1$). These effects were qualified by a significant interaction between type of preactivation and matching, $F(1, 41) = 9.76$, $p = .003$, $\eta_p^2 = .19$. Planned contrast analyses showed that experienced self-agency over mismatching outcomes was lower for goals than for outcome primes, $F(1, 41) = 5.84$, $p = .02$, $\eta_p^2 = .13$. The difference between goals and primes in experienced self-agency over matching outcomes did not reach the conventional level of significance, $F(1, 41) = 3.77$, $p = .06$, $\eta_p^2 = .08$. Furthermore, experienced self-agency was higher over matching than over mismatching outcomes in both the priming, $F(1, 41) = 6.65$, $p = .01$, $\eta_p^2 = .14$, and the goal condition, $F(1, 41) = 34.79$, $p < .001$, $\eta_p^2 = .46$.

Pattern analyses. To gain more insight in the pattern of decrease for the goal and prime conditions, we conducted several contrast analyses. We hypothesized that experienced self-agency would drop for any outcome that mismatches a goal, regardless of the extent to which the outcome mismatches in distance (which should be represented by an immediate decrease pattern). We further hypothesized that in case of outcome priming, effects on experienced self-agency would emerge as a function of the distance to which the primed outcome representation matches the observed outcome. Thus, experienced self-agency should gradually decrease as the spatial discrepancy increases and the association between primed and actual outcome decreases (which may be more represented by a linear decrease pattern). To test these specific hypotheses, we first conducted single pattern contrast analyses that test whether the decrease in experienced self-agency in the goal and prime conditions is linear and/or immediate. Next, we conducted multiple pattern contrast analyses to test which pattern best fits the decrease in experienced self-agency in the goal versus prime conditions.

Single pattern analyses. First of all, the linear contrast analysis showed a linear decrease in experienced self-agency in the goal condition, $F(1, 41) = 33.97$, $p < .001$, $\eta_p^2 = .45$, as well as in the prime condition, $F(1, 41) = 4.07$, $p = .05$, $\eta_p^2 = .09$. This linear trend was stronger for the goal condition than for the prime condition, as was evidenced by the significant interaction effect for the linear trend, $F(1, 41) = 27.89$, $p < .001$, $\eta_p^2 = .33$. Second, we tested a pattern of immediate decrease in which the matching condition is contrasted against all mismatching conditions together (contrast coefficients being: $4\ -1\ -1\ -1\ -1$), for both the goal and prime conditions. These analyses showed an immediate decrease in experienced self-agency in the goal condition, $F(1, 41) = 40.76$, $p < .001$, $\eta_p^2 = .50$, as well as in the prime condition, $F(1, 41) = 5.61$, $p = .02$, $\eta_p^2 = .12$. This immediate decrease contrast was stronger for the goal condition than for the prime condition, $F(1, 41) = 41.70$, $p < .001$, $\eta_p^2 = .50$.

The finding that both the linear and immediate decrease contrasts are significant for the goal and prime conditions makes sense. After all, in both conditions experienced self-agency is highest when outcomes match compared to all levels of mismatch.

Furthermore, the contrasts are stronger for goals than for primes since self-agency over mismatching outcomes is lower in the goal compared to the prime condition, thereby rendering the total amount of decrease in the goal condition larger than in the prime condition. However, according to our hypothesis, the immediate (vs. linear) pattern of decrease should fit better in the goal condition than in the prime condition. To test this we performed multiple pattern contrast analyses.

Multiple pattern analyses. For this purpose, we followed the functional analysis procedure suggested by Furr and Rosenthal (2003). Specifically, for each participant, we multiplied the mean agency rating for each level of matching with the standardized contrast coefficients associated with these levels of matching for both a linear (unstandardized coefficients being: 2 1 0 − 1 −2) and immediate decrease pattern (unstandardized coefficients being: 4 − 1 −1 −1 −1). We then calculated the sum of the products for each pattern and conducted *t* tests to examine whether the sum of the two patterns differ for the goal and prime conditions. First, results showed that the immediate decrease pattern (M_{sum} = 3.40, SD = 3.45) fits the pattern of decrease in the goal condition better than the linear decrease pattern (M_{sum} = 2.78, SD = 3.10), $t(41)$ = 2.74, p = .009. For the prime condition, however, the fit of the linear pattern (M_{sum} = .93, SD = 3.00) did not differ from the fit of the immediate pattern of decrease (M_{sum} = .94, SD = 2.58), $t < 1$, *ns*, suggesting that the course of decrease in experienced self-agency in the prime condition is both linear and immediate.

Discussion

The results of Experiment 3 indicate that the decrease in experienced self-agency in the goal condition is best described by a strong and persistent drop in self-agency between the matching trials and trials that mismatched (see Figure 5). Thus, in case of goal-directed behavior, inferences of self-agency are outcome-specific and do not allow people to experience self-agency over mismatching outcomes, regardless of the degree of (spatial) discrepancy between intended and actual outcomes. Yet, the decrease in experienced self-agency in the prime condition is described equally well by a linear as well as an immediate pattern of decrease. This suggests that primes leave room for the perception of a match between the outcome prime and an outcome that in actuality mismatches, as long as the actual outcome is associated with, and activated by, the primed outcome. The results further indicate that, although outcome primes can enhance experienced self-agency over associated outcomes, these effects are not as strong as exact matches. That is, there is a small immediate decrease in experienced self-agency for mismatching compared to matching outcomes, and experienced self-agency continues decreasing in a gradual fashion as the discrepancy between primed and actual outcome increases.

In sum, then, results of Experiment 3 showed that varying degrees of mismatching affected experienced self-agency in a different way when participants had a goal to produce a specific outcome than when they were merely primed with the outcome. The experience of self-agency dropped steeply and remained low when the goal mismatched with any of the other possible outcomes. However, priming a specific outcome caused a gradual decrease in self-agency as a function of the distance between the observed outcome and the primed outcome.

General Discussion

In the past few years, the experience of self-agency has emerged as an exciting and important challenge for the understanding of human self-perception and volition. Research in this field suggests that self-agency arises from an explicit goal-directed process or a more implicit outcome priming process (e.g., Aarts et al., 2005; Wegner & Wheatley, 1999). That is, experienced self-agency results from inferences that we draw from our purposes to engage in behavior (i.e., goals), as well as from inferences that originate from our unconscious mind that produces a heightened sense of authorship merely because we presaged an outcome before it occurs (e.g., due to priming).

Until now, these two routes to self-agency have been largely treated as similar in terms of operations and effects. Importantly though, previous research only compared the effects of goals and outcome-primes on experienced self-agency over matching action-outcomes (Aarts et al., 2005). Crucially, previous research did not take into account that goals and primes are different in terms of operations that specifically pertain to goals, such as attention, monitoring and shielding (e.g., Custers & Aarts, 2005, 2010; Förster et al., 2007), properties that may influence inferences of self-agency, especially when outcomes are incongruent with goals or outcome-primes.

To examine potential differences between the two routes to self-agency, in the present study we directly compared the effects of goals and primes on self-agency as a function of matches and mismatches with the outcome. In line with previous work, three experiments demonstrate that when outcomes match either a goal or an outcome prime, experiences of self-agency are enhanced. Importantly, the present experiments further provide a novel and exciting result, namely, that the effects of goals and primes on experienced self-agency diverge when outcomes mismatch these goals and primes. That is, whereas outcomes that mismatch a person's goal instantly decreased experienced self-agency, outcomes that mismatch a primed outcome could even enhance experienced self-agency. Specifically, when we introduced intermediate spatial discrepancies between primed and observed outcomes, this caused a gradual decrease in self-agency over mismatches as a result of the distance between the primed and observed outcomes. Yet, experienced self-agency over outcomes that mismatch a person's goal decreased irrespective of the distance or discrepancy between the outcome and the goal. Thus, when and how people arrive at a sense of self-agency over outcomes depends on whether self-agency inferences are based on outcome representations that are preactivated by goals or by outcome primes. By showing these divergent effects of goals and primes, the present findings extend previous work on the emergence of self-agency, providing clear evidence that there are two qualitatively different inferential routes to experiences of self-agency.

The present findings may have implications for models of self-agency that focus on multilevel action perception (Pacherie, 2008) and optimal cue integration (Synofzik, Vosgerau, & Lindner, 2009). These models propose that there are multiple routes to experienced self-agency that each depend on different cues and that agency relies on the momentarily most relevant and informative cues. A main issue addressed in these models concerns the distinction and integration of internal motor prediction cues (e.g., derived from intentional action) and cognitive inferential cues (e.g., derived from outcome priming). Previous research examin-

ing this issue shows that motor predictions and cognitive inferences independently affect experiences of self-agency (e.g., Moore et al., 2009; C. Preston & Newport, 2010; Sato, 2009; van der Weiden et al., 2011). Interestingly, recent research suggests that motor predictions only affect experiences of self-agency when relevant actions and outcomes are learned to be causally related, that is, when people can predict the sensory consequences of an action. However, inference effects as a result of previews of outcomes even occur when no relevant causal knowledge is acquired (van der Weiden et al., 2011).

These latter results concur with the present finding, showing that preactivation of outcome information through goals and primes affects experienced self-agency even when motor prediction and control is absent. In addition, the present findings open new avenues for research on cue integration as the present findings suggest that it may matter for the experience of agency whether the preactivated outcome originates from goals or primes. For example, our current findings raise the novel question of how these different cognitive outcome-related cues are weighted in the establishment of self-agency experiences. The present findings shed first light on this issue by showing that mismatching outcome information is differentially included in the inferential process underlying experienced self-agency, depending on the source of activation of the outcome-related cue (i.e., goal or prime). Furthermore, future research on optimal cue integration in the establishment of the sense of self-agency might explore whether motor prediction cues and cognitive inference cues are integrated differently when the inference is based on goals or primes. For instance, based on the notion that "a goal is that which an individual is trying to accomplish; it is the objective or aim of an *action* [emphasis added]" (Weinberg, 1996, p. 4), one could argue that action execution and, accordingly, motor prediction cues are more important for goal effects on agency than for priming effects. For example, when one has the explicit goal to cheer someone up by making funny faces, one may not experience self-agency over the other person's cheerfulness if one has done nothing to cheer that person up (i.e., when one has not made a funny face). Yet, when merely being primed with cheerfulness one may experience enhanced self-agency over the other person's cheerfulness without having done anything to cheer that person up (see also Ruys & Aarts, 2012). In other words, primes are more capable to cause agency inferences without action or motor movement (see also Moore et al., 2009), while motor movement may be required to yield goal effects on agency.

With regard to the contribution of cognitive agency cues, the present findings show that only in a goal-directed context, matching as well as mismatching outcome information contributes to inferences of self-agency. Yet, when outcomes are primed, mismatching outcome information does not affect experienced self-agency. Hereby, the present findings offer initial support for our notion that mismatching outcomes are more relevant for self-agency when having a goal rather than when being primed with an outcome representation. However, we do not know whether goals and primes always have these distinctive effects on self-agency, challenging the situational generality of our findings. For example, there may be situations in which information about mismatches between intended and actual outcomes is less relevant for establishing a sense of agency. Specifically, since experienced self-agency seems to depend on goal achievement, people may experience enhanced self-agency over goal progress even though the achievement so far does not match the desired end state. Accordingly, although partial goal achievement still mismatches the initial goal, it may enhance experienced self-agency over mismatching proximate outcomes as long as there is a sense of goal progress.

In the present research, mismatching outcomes were not indicative of goal progress; one could simply achieve the desired outcome, or not. In this context, matching and mismatching outcomes have divergent effects on experienced self-agency. This finding concurs with research in the area of self-attribution, showing that people overattribute successful (matching) outcomes to themselves and unsuccessful (mismatching) outcomes to others. Research on self-attributions has provided motivational and cognitive explanations for when people resort to such self-serving attributions (e.g., Bradley, 1978; Miller & Ross, 1975; Tetlock & Levi, 1982; see for a recent review, Shepperd et al., 2008). The bottom line is that goals are strongly attuned to successful as well as unsuccessful outcomes because both success and failure are important aspects of learning, decision making, and performance in the service of goal achievement (Aarts & Elliot, 2012). Importantly, in the light of experiences of self-agency, recent research suggests that successful and unsuccessful outcomes only affect motivation, emotional regulation, and performance when people attribute these outcomes to themselves (Neumann, 2000; Steinhauser & Kiesel, 2011). The present work thus may offer new insights for research on goal achievement and agency by exploring how the mode of preactivation of outcomes (prime vs. goals) impacts on self-agency experiences and downstream consequences for emotion and motivation.

One interesting avenue in this respect pertains to the issue of whether it matters whether goals are self-chosen or not. Choice impacts many aspects of social behavior, such as cognitive dissonance and persuasion (Festinger, 1957), reactance or indifference to specific treatments (Brehm, 1966), and interest in a specific task (Deci & Ryan, 1985). Furthermore, choice likely influences people's emotional and motivational responses to matches and mismatches. For instance, an extensive body of research on goal setting and self-determination indicates that self-chosen and externally assigned goals have different effects on motivation. Specifically, people become more motivated after success when people choose their own goal than when people are assigned a certain goal (e.g., Deci & Ryan, 2000; Patall, Cooper, & Robinson, 2008). Importantly, it has been suggested that these effects occur because people experience more self-agency over outcomes they have chosen to pursue themselves (e.g., DeCharms, 1968; Leotti, Iyengar, & Ochsner, 2010; Ryan & Deci, 2006). Consequently, agency is considered central to goal setting and performance.

However, research on the role of goals in action control indicates that both self-chosen and assigned goals instigate similar control processes that support goal attainment (Aarts & Elliot, 2012). In principle, then, self-chosen goals and assigned goals may have similar effects on experiences of self-agency as a function of matches and mismatches. Hence, assuming that the experience of self-agency emerges through the same goal-directed control processes, regardless of their source (i.e., self-chosen or externally given goals), the hypothesis that effects of choice on motivation are mediated by experienced agency becomes unlikely. The present findings thus suggest that although the effects of goals on agency and motivation may co-occur, they are not necessarily

related. This line of reasoning is of course speculative and awaits future testing.

Concluding Remarks

Self-agency experiences are essential to self-perception and social interaction (e.g., Walker, Kestler, Bollini, & Hochman, 2004; Wegner, 2002). Therefore, it is important to understand when and how people arrive at the experience of self-agency. Previous research has already convincingly demonstrated that people infer self-agency from their purposes to engage in behavior (i.e., goals), as well as from environmental cues that activate the representation of an outcome before it occurs (e.g., due to priming). Importantly, by linking research on self-agency experiences to current knowledge and recent developments in research on goal-directed behavior, we extend this previous research by offering new evidence that two distinct inferential routes to experienced self-agency exist, depending on whether self-agency inferences are based on goals or outcome-primes. Notably then, goals and primes differentially affect the perception of our own behavior.

References

Aarts, H. (2007). On the emergence of human goal pursuit: The nonconscious regulation and motivation of goals. *Social & Personality Psychology Compass,* 183–201.

Aarts, H. (2012). Goals, motivated social cognition and behavior. In S. Fiske & C. N. Macrae (Eds.), *SAGE handbook of social cognition*. London, England: Sage.

Aarts, H., Custers, R., & Marien, H. (2009). Priming and authorship ascription: When nonconscious goals turn into conscious experiences of self-agency. *Journal of Personality and Social Psychology, 96,* 967–979. doi:10.1037/a0015000

Aarts, H., Custers, R., & Wegner, D. M. (2005). On the inference of personal authorship: Enhancing experienced agency by priming effect information. *Consciousness and Cognition, 14,* 439–458. doi:10.1016/j.concog.2004.11.001

Aarts, H., & Elliot, A. (2012). *Goal-directed behavior*. New York, NY: Psychology Press.

Aarts, H., Oikawa, M., & Oikawa, H. (2010). Cultural and universal routes to authorship ascription: Effects of outcome priming on experienced self-agency in the Netherlands and Japan. *Journal of Cross-Cultural Psychology, 41,* 87–98. doi:10.1177/0022022109349511

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. *American Psychologist, 54,* 462–479. doi:10.1037/0003-066X.54.7.462

Bargh, J. A., & Williams, L. E. (2007). The unconscious regulation of emotion. In J. Gross (Ed.), *Handbook of emotion regulation* (pp. 429–445). New York, NY: Guilford Press.

Baumeister, R. F., Schmeichel, B. J., & Vohs, K. D. (2007). Self-regulation and the executive function: The self as controlling agent. In A. W. Kruglanski & E. T. Higgins (Eds.), *Social psychology: Handbook of basic principles* (pp. 516–539). New York, NY: Guilford Press.

Bradley, G. W. (1978). Self-serving biases in the attribution process: A reexamination of the fact or fiction question. *Journal of Personality and Social Psychology, 36,* 56–71. doi:10.1037/0022-3514.36.1.56

Brehm, J. W. (1966). *A theory of psychological reactance*. New York, NY: Academic Press.

Brownell, C. A., & Carriger, M. S. (1990). Changes in cooperation and self–other differentiation during the second year. *Child Development, 61,* 1164–1174. doi:10.2307/1130884

Carver, C. S., & Scheier, M. F. (1998). *On the self-regulation of behavior*: New York, NY: Cambridge University Press. doi:10.1017/CBO9781139174794

Collins, A. M., & Loftus, E. F. (1975). A spreading-activation theory of semantic processing. *Psychological Review, 82,* 407–428. doi:10.1037/0033-295X.82.6.407

Custers, R., & Aarts, H. (2005). Beyond priming effects: The role of positive affect and discrepancies in implicit processes of motivation and goal pursuit. *European Review of Social Psychology, 16,* 257–300. doi:10.1080/10463280500435919

Custers, R., & Aarts, H. (2007). Goal-discrepant situations prime goal-directed actions if goals are temporarily or chronically accessible. *Personality and Social Psychology Bulletin, 33,* 623–633. doi:10.1177/0146167206297404

Custers, R., & Aarts, H. (2010). The unconscious will: How the pursuit of goals operates outside of conscious awareness. *Science, 329,* 47–50. doi:10.1126/science.1188595

Custers, R., Aarts, H., Oikawa, M., & Elliot, A. (2009). The nonconscious road to perceptions of performance: Achievement priming augments outcome expectancies and experienced self-agency. *Journal of Experimental Social Psychology, 45,* 1200–1208. doi:10.1016/j.jesp.2009.07.013

Decety, J., & Chaminade, T. (2003). When the self represents the other: A new cognitive neuroscience view on psychological identification. *Consciousness and Cognition, 12,* 577–596. doi:10.1016/S1053-8100(03)00076-X

DeCharms, R. (1968). *Personal causation*. New York, NY: Academic Press.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum Press.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11,* 227–268. doi:10.1207/S15327965PLI1104_01

Dijksterhuis, A., & Aarts, H. (2010). Goals, attention, and (un)consciousness. *Annual Review of Psychology, 61,* 467–490. doi:10.1146/annurev.psych.093008.100445

Festinger, L. (1957). *A theory of cognitive dissonance*. Stanford, CA: Stanford University Press.

Fishbach, A., & Ferguson, M. J. (2007). The goal construct in social psychology. In A. W. Kruglanski & E. T. Higgins (Eds.), *Social psychology: Handbook of basic principles* (pp. 490–515). New York, NY: Guilford Press.

Förster, J., Liberman, N., & Friedman, R. S. (2007). Seven principles of goal activation: A systematic approach to distinguishing goal priming from priming of non-goal constructs. *Personality and Social Psychology Review, 11,* 211–233. doi:10.1177/1088868307303029

Furr, R. M., & Rosenthal, R. (2003). Repeated-measures contrasts for "multiple-pattern" hypotheses. *Psychological Methods, 8,* 275–293. doi:10.1037/1082-989X.8.3.275

Haggard, P. (2008). Human volition: Towards a neuroscience of will. *Nature Reviews Neuroscience, 9,* 934–946. doi:10.1038/nrn2497

Leotti, L. A., Iyengar, S. S., & Ochsner, K. N. (2010). Born to choose: The origins and value of the need for control. *Trends in Cognitive Sciences, 14,* 457–463. doi:10.1016/j.tics.2010.08.001

McNamara, T. P., Ratcliff, R., & McKoon, G. (1984). The mental representation of knowledge acquired from maps. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 10,* 723–732.

Miller, D. T., & Ross, M. (1975). Self-serving biases in the attribution of causality: Fact or fiction? *Psychological Bulletin, 82,* 213–225. doi:10.1037/h0076486

Moore, J. W., Wegner, D. M., & Haggard, P. (2009). Modulating the sense of agency with external cues. *Consciousness and Cognition, 18,* 1056–1064. doi:10.1016/j.concog.2009.05.004

Neumann, R. (2000). The causal influences of attributions on emotions: A procedural priming approach. *Psychological Science, 11,* 179–182. doi:10.1111/1467-9280.00238

Newell, F. N., Sheppard, D. M., Edelman, S., & Shapiro, K. L. (2005). The interaction of shape- and location-based priming in object categorisation: Evidence for a hybrid "what + where" representation stage. *Vision Research, 45,* 2065–2080. doi:10.1016/j.visres.2005.02.021

Pacherie, E. (2008). The phenomenology of action: A conceptual framework. *Cognition, 107,* 179–217. doi:10.1016/j.cognition.2007.09.003

Patall, E. A., Cooper, H., & Robinson, J. C. (2008). The effects of choice on intrinsic motivation and related outcomes: A meta-analysis of research findings. *Psychological Bulletin, 134,* 270–300. doi:10.1037/0033-2909.134.2.270

Piaget, J. (1954). *The construction of reality in the child*. New York, NY: Basic Books. doi:10.1037/11168-000

Powers, W. T. (1973, January 26). Feedback: Beyond behaviorism. *Science, 179,* 351–356.

Preston, C., & Newport, R. (2010). Self-denial and the role of intentions in the attribution of agency. *Consciousness and Cognition, 19,* 986–998. doi:10.1016/j.concog.2010.04.005

Preston, J. L., Ritter, R. S., & Wegner, D. M. (2011). Action embellishment: An intention bias in the perception of success. *Journal of Personality and Social Psychology, 101,* 233–244. doi:10.1037/a0023231

Rochat, P., & Striano, T. (2000). Perceived self in infancy. *Infant Behavior & Development, 23,* 513–530. doi:10.1016/S0163-6383(01)00055-8

Ruys, K. I., & Aarts, H. (2012). I did not mean to hurt you! Unconscious origins of experienced self-agency over other's emotional expressions, *Emotion, 12,* 132–141. doi:10.1037/a0023161

Ryan, R. M., & Deci, E. L. (2006). Self-regulation and the problem of human autonomy: Does psychology need choice, self-determination, and will? *Journal of Personality, 74,* 1557–1586. doi:10.1111/j.1467-6494.2006.00420.x

Sato, A. (2009). Both motor prediction and conceptual congruency between preview and action-effect contribute to explicit judgment of agency. *Cognition, 110,* 74–83. doi:10.1016/j.cognition.2008.10.011

Shepperd, J. A., Malone, W., & Sweeny, K. (2008). Exploring causes of the self-serving bias. *Social & Personality Psychology Compass, 2,* 895–908. doi:10.1111/j.1751-9004.2008.00078.x

Spengler, S., von Cramon, D. Y., & Brass, M. (2009). Was it me or was it you? How the sense of agency originates from ideomotor learning revealed by fMRI. *NeuroImage, 46,* 290–298. doi:10.1016/j.neuroimage.2009.01.047

Steinhauser, M., & Kiesel, A. (2011). Performance monitoring and the causal attribution of errors. *Cognitive, Affective, & Behavioral Neuroscience, 11,* 309–320. doi:10.3758/s13415-011-0033-2

Synofzik, M., Vosgerau, G., & Lindner, A. (2009). Me or not me—An optimal integration of agency cues? *Consciousness and Cognition, 18,* 1065–1068. doi:10.1016/j.concog.2009.07.007

Tetlock, P. E., & Levi, A. (1982). Attribution bias: On the inconclusiveness of the cognition-motivation debate. *Journal of Experimental Social Psychology, 18,* 68–88. doi:10.1016/0022-1031(82)90082-8

Vallacher, R. R., & Wegner, D. M. (1987). What do people think they're doing? Action identification and human behavior. *Psychological Review, 94,* 3–15. doi:10.1037/0033-295X.94.1.3

van der Weiden, A., Aarts, H., & Ruys, K. I. (2010). Reflecting on the action or its outcome: Behavior representation level modulates high level outcome priming effects on self-agency experiences. *Consciousness and Cognition, 19,* 21–32. doi:10.1016/j.concog.2009.12.004

van der Weiden, A., Aarts, H., & Ruys, K. I. (2011). Prime and probability: Causal knowledge affects inferential and predictive effects on self-agency experiences. *Consciousness and Cognition, 20,* 1865–1871. doi:10.1016/j.concog.2011.09.007

Walker, E., Kestler, L., Bollini, A., & Hochman, K. M. (2004). Schizophrenia: Etiology and course. *Annual Review of Psychology, 55,* 401–430. doi:10.1146/annurev.psych.55.090902.141950

Wegner, D. M. (2002). *The illusion of conscious will*. Cambridge, MA: MIT Press.

Wegner, D. M., Sparrow, B., & Winerman, L. (2004). Vicarious agency: Experiencing control over the movements of others. *Journal of Personality and Social Psychology, 86,* 838–848. doi:10.1037/0022-3514.86.6.838

Wegner, D. M., & Wheatley, T. P. (1999). Apparent mental causation: Sources of the experience of will. *American Psychologist, 54,* 480–492. doi:10.1037/0003-066X.54.7.480

Weinberg, R. S. (1996). Goal setting in sport and exercise: Research to practice. In J. L. Van Raalte & B. W. Brewer (Eds.), *Exploring sport and exercise psychology* (pp. 3–24). Washington, DC: American Psychological Association. doi:10.1037/10186-001

Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review, 92,* 548–573. doi:10.1037/0033-295X.92.4.548

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