When You Think You Know What *You're* Doing:

Experiencing Self-Agency Over Intended and Unintended Outcomes

Anouk van der Weiden

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When You Think You Know What *You're* Doing:

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Wanneer je denkt te weten wat *jij* doet:
Het ervaren van zelf-causatie over beoogde en niet-beoogde uitkomsten
(met een samenvatting in het Nederlands)

Proefschrift

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Anouk van der Weiden

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Promotor: **Prof. dr. H. Aarts**

Co-promotor: **Dr. K. I. Ruys**

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Introduction and Overview

Introduction

“Know what you are doing! If you don't know what you're doing, then you can't do what you want" was the maxim of physicist Moshe Feldenkrais (1904-1984). Evidently, knowing what one is doing requires one to reflect on one’s own behavior, which is something humans are very capable of, do so regularly, and engage in with great ease. Indeed, already in early infancy (e.g., Brownell & Carriger, 1990; Decety & Chaminade, 2003; Piaget, 1954; Rochat & Striano, 2000), and throughout the rest of our life, the actions we conduct and the outcomes they produce are typically accompanied by feelings of self-causation: It is I who is doing it. This basic feeling of self-causation originates from sensorimotor signals at the motor level that are associated with action planning and performance, and is also referred to as the feeling of agency (cf. Synofzik, Vosgerau, & Newen, 2008).

Since humans rarely act in social isolation, they usually further have to dissociate their own actions and their subsequent sensations from those of others in order to know what *they* are doing. For example, when several individuals in a person’s direct environment start laughing, is that because of something he or she did or said, or because of the funny haircut of someone who just walked by? In such ambiguous social situations, people cannot merely rely on a basic agency-feeling to arrive at the experience that they (rather than someone else) caused a certain event. Rather, people also include conceptual interpretative agency cues such as social cognitions (e.g., who has more power?) and knowledge about action-outcomes (e.g., does the outcome match one’s goals?) (e.g., Synofzik et al., 2008; Wegner, Sparrow, & Winerman, 2004). As a consequence, people may experience self-agency over events independent of actual self-causation.

Because most of the behaviors we engage in are accompanied by experiences of self-agency, it may come as no surprise that these experiences can have important implications. First, experiencing which outcomes one has or has not caused is essential to how one perceives oneself as a person, and to one's feelings of control over the environment and one's future behavior (e.g., Jeannerod, 2003; Rochat & Striano, 2000). Apart from this self-regulatory function, the experience of self-agency, or the lack hereof, has important social implications. After all, if people would not be able to determine the causal agent in a situation, they would not know who they should thank, blame, or apologize to, which would be quite detrimental for social interaction (e.g., Brownell & Carriger, 1990; Kelly, 1972; Ruys & Aarts, 2012). Indeed, people who do not know what *they* are doing, and hence, have difficulty distinguishing between the outcomes of their own actions and those of others, also struggle with social interactions (e.g., Walker, Kestler, Bollini, & Hochman, 2004). Finally, self-agency has been associated with well-being and happiness (Taylor & Brown, 1988), and abnormalities in experienced self-agency have been related to major mental health problems. Specifically, the lack of experiencing self-agency has been proposed to play an important role in obsessive compulsive checking behavior (OCD; Belayachi & Van der Linden, 2009, 2010) and auditory hallucinations or experiences of alien control as experienced by some schizophrenia patients (e.g., Blakemore, Smith, Steel, Johnstone, & Frith, 2000; Franck, Farrer, & Georgieff, 2001; Frith, Blakemore, & Wolpert, 2000b; Frith & Done, 1989; Jones, de-Wit, Fernyhough, & Meins, 2008).

Given the pervasiveness of self-agency experiences in human daily life, and their diverse and substantial implications for self and others, it is important to understand when and how experiences of self-agency emerge. The present dissertation addresses and examines a few key issues with the aim to further the understanding of the human experience of self-

agency. Before presenting a more detailed overview of the present dissertation, I will first briefly introduce the two main models on self-agency experiences and address the key questions that were examined in the present dissertation project.

On the Emergence of Self-Agency Experiences

One of the first models to explain how experiences of self-agency emerge is the so-called comparator model (e.g., Wolpert, Ghahramani, & Jordan, 1995; Blakemore, Wolpert, & Frith, 2002). According to this model, the motor control system produces efferent signals by predicting the sensory outcomes of people's volitional or goal-directed actions. For instance, when planning to grab a cup of coffee, the motor system predicts the amount of pressure needed to lift the cup (Wolpert & Flanagan, 2001). The efferent signals are then compared to the afferent feedback as provided by the observed sensory outcomes of action (e.g., the actual amount of pressure needed to lift the cup of coffee). A match between predicted (efferent) and observed (afferent) sensations then produces a feeling of agency (e.g., Blakemore et al., 2002; Moore & Haggard, 2008).

More recently, a second model on the emergence of self-agency experiences has been proposed that takes into account, and emphasizes, the role of people's cognitions about action-outcomes (Wegner, 2002). Specifically, this model posits that people *infer* self-agency over outcomes based on cognitively represented outcome previews, often operationalized as goals (Wegner, 2002; for a related approach see also Jeannerod, 2006; Prinz, 2003). The basic premise of this second model is that when the outcome of one's action matches the outcome one had in mind (e.g., when one is thirsty and grabs a cup of coffee), one experiences self-agency over the outcome—irrespective of whether one truly caused the outcome or not.

Although these motor predictive and cognitive inferential mechanisms are distinct and independent in terms of operations and effects (e.g., Moore, Wegner, & Haggard, 2009; C. Preston & Newport, 2010; Sato, 2009; van der Weiden, Aarts, & Ruys, 2011), in principle, both models suggest that people's goals play an important role in the emergence of self-agency experiences. Clearly, the goals people set, pursue, and attain are often accompanied by experiences of self-agency over behavior. However, this does not seem to be the whole story. Research over the last decade indicates that human behavior can be triggered by environmental cues without the intervention of conscious intention. Importantly, this environmentally triggered behavior produces outcomes that were thus not intended, or planned, but over which one can nevertheless experience self-agency (e.g., Bargh & Chartrand, 1999; Custers & Aarts, 2010).

This notion raises two intriguing questions. First of all, how do people arrive at the conscious experience of self-agency over outcomes that are not planned (i.e., unintended)? Recent research has already revealed that, without an intention to produce a specific outcome in mind, experiences of self-agency can be accounted for by the inferential approach to self-agency (Aarts, Custers, & Wegner, 2005). That is, pre-activating the representation of an action-outcome (e.g., by means of priming) during action performance causes people to infer self-agency over this outcome. This way, the inferential approach to self-agency experiences is also able to explain experiences of self-agency over outcomes that are unintended, unexpected, or unpredicted (e.g., Dogge, Schaap, Custers, Wegner, & Aarts, 2012; Moore & Haggard, 2008; Moore, Wegner, et al., 2009; van der Weiden et al., 2011), which cannot easily be addressed by the motor prediction account. However, *when* and *how* people infer self-agency as a result of outcome priming is still not fully understood. A second question that arises is whether experiences of self-agency resulting from implicit sources (e.g., outcome priming) differ from experiences of self-agency

resulting from goal-directed sources, and in what manner? Because goals are conceptualized as different from mere outcome primes in terms of their self-regulatory function and control of behavior (e.g., Fishbach & Ferguson, 2007; Förster, Liberman, & Friedman, 2007), goals (vs. primes) may affect the inferential process of self-agency in a different way.

The present dissertation examines these questions by studying the inferential process that underlies self-agency experiences and the role of goal-directed processes in this authorship ascription process. Specifically, it deals with a few specific situations that may moderate outcome priming effects on inferences of self-agency, namely the role of causal knowledge of action-outcome relations and behavior representation levels. Furthermore, I present studies that directly compare outcome priming and goals in their effects on experiences of self-agency to shed more light on possible differences in the mechanisms by which goals versus outcome primes lead to self-agency experiences.

Causal Knowledge of Action-Outcome Relations

The first situation pertains to the role of causal knowledge of action-outcome relations in experiences of self-agency. Causal knowledge of action-outcome relations refers to knowledge that people have about the probability that their actions are followed by specific outcomes (Chatlosh, Neunaber, & Wasserman, 1985; Dickinson & Shanks, 1995). For example, one person may have learned that a green light turns on in 80% of the cases in which one presses a left button and in 20% of the cases when one pushes a right button. Another person may have learned that the action-outcome (left/right leads to green light) contingency is 50%, that is, the outcome occurs by chance. Such knowledge of action-outcome relations is used to set goals and to predict whether the desired outcome will occur when the associated action is performed (Shanks & Dickinson, 1991). Thus, causal

knowledge of action-outcome relations is an important component in the study of self-agency experiences, because it allows for a test of the combined contribution of motor predictions and cognitive inferences to experienced self-agency.

Whereas it has been shown that motor prediction effects on experiences of self-agency crucially rely on knowledge of action-outcome relations (Moore & Haggard, 2008; Moore, Lagnado, Deal, & Haggard, 2009), less is known about the role of causal knowledge in inferences of self-agency. According to the theory of apparent mental causation (Wegner, 2002), inferences of self-agency crucially depend on the perceived causality between a person's actions and the outcomes that follow. This makes sense especially in case of goal-directed behavior, where one needs to know in advance what actions are instrumental in attaining one's goal (e.g., Aarts & Elliot, 2012; Dickinson & Shanks, 1995). Still, even when one has no specific goal but is merely primed with an outcome, it would be odd to infer self-agency over an outcome if one has learned that this outcome cannot possibly have resulted from one's action (i.e., when pushing the ENTER-button is followed by rainfall). Yet, since inferential priming effects on experienced self-agency have been shown to occur in the absence of actual action execution (Wegner, 2002; Wegner et al., 2004), it remains to be seen whether causal knowledge of action-outcome relations plays a role in inferences of self-agency over primed outcomes.

What may be important here is whether people have knowledge of relevant action-outcome relations. That is, one is unlikely to infer self-agency over outcomes of which one has learned that they are unrelated to the action one performed (e.g., when outcome follows one's action by chance). However, when one has no relevant causal knowledge, one may still infer self-agency over the outcome of one's action (e.g., when people

experience self-agency over novel outcomes that result from their actions). Note that in both of these cases, the motor system cannot predict the sensory consequences of action, and hence, motor prediction effects should be absent. Inference effects, however, may thus depend on the perceived consistency between actions and outcomes, not only in case of intended, but also in case of unintended (primed) outcomes. Therefore, it is important to take into account the role of causal knowledge in order to shed more light on how experiences of self-agency that result from mere outcome primes relate to experiences of self-agency resulting from goals.

Behavior Representation Levels

Second, the present dissertation considers how different levels of behavior representation impact on inferences of self-agency. That is, beside the idea that outcomes have to be consistent with one's actions, it has been established that outcomes have to be consistent with the outcomes represented in one's mind before performing an action (e.g., Aarts, Custers, & Wegner, 2005; Wegner, 2002). According to action identification theory (Vallacher & Wegner, 1987; Wegner & Vallacher, 1986), people can represent their behavior at different levels; in terms of how they perform certain actions (low level), or in terms of why they perform certain actions (high level). Importantly, the way people represent the outcomes of their actions may differ depending on whether people have a goal in mind or whether they engage in behavior that may lead to unintended outcomes. When people have a specific goal (e.g., making music), they inevitably represent their actions in terms of *why* they perform these actions, that is, in terms of the specific desired outcome, or goal (e.g., in terms of making music).

Yet, in the absence of a specific goal, people may vary in the level at which they represent their behavior (e.g., in terms of making music, but

also in terms of moving one's fingers or touching the strings) as a function of individual and contextual differences (Vallacher & Wegner, 1985). Such differences may pertain to self-conceptions, such as whether one conceives oneself as a planner (high level *outcome* identifier) rather than a doer (low level *action* identifier), or to situations in which one is forced to focus attention on one's action rather than the outcome, for example when action performance is obstructed. Accordingly, individual and contextual differences may modulate inferences of self-agency by rendering people more or less prone to rely on outcome primes to arrive at the experience of agency because the primed outcome does not match the way they represent the outcome of their behavior. Hence, in order to understand when and how experiences arise as a result of mere outcome priming (in the absence of a goal to produce a specific outcome), it is important to consider whether it matters that people represent their behavior in terms of the outcomes of their action for the experience self-agency over this outcome.

Goals versus Primes

Finally, in the present dissertation the effects of goals and primes on experienced self-agency are directly compared. Based on the idea that it matters how people represent the outcomes of their actions, it logically follows that it may also matter whether an outcome is represented as a goal or not. Both goals and primes have been shown to enhance experiences of self-agency when outcomes match these goals and primes. However, this does not necessarily suggest that goals and primes affect agency processing in the same way.

Other than primed outcome representations, goals evoke unique control processes that deal with monitoring and feedback processing (e.g., Aarts, 2007b; Carver & Scheier, 1998; Moskowitz, Li, & Kirk, 2004), processes that may be especially important when outcomes mismatch one's

goal. Goals and primes may thus differ in their effects on experiences of self-agency over mismatching outcomes. Specifically, whereas outcome primes may spread activation to outcomes that are associated to the primed outcome, and as a result, may enhance experienced self-agency over a multitude of outcomes, goals cause people to focus on one specific outcome. Furthermore, because people generally expect their goal-directed actions to be successful, they are likely to experience self-agency only over outcomes that fully match the goal. This hypothesized divergence in the effects of goals and primes on experiences of self-agency has important implications for current models on how experiences of self-agency arise and for processes associated with goal-achievement, such as emotion and motivation.

In sum, with the present dissertation, I aim to enhance the understanding of when and how people arrive at the experience of self-agency over both intended and unintended (e.g., primed or mismatching) outcomes, by studying the role of causal knowledge, behavior representations, and goal-directed processes in the emergence of self-agency experiences. I will now present a brief overview of the chapters that will follow.

Overview

Chapter 2 – On the nature of experiencing agency: Inferring oneself as the cause of intended and unintended outcomes (van der Weiden, Aarts, & Ruys, submitted). In Chapter 2 of this dissertation, an overview will be presented dealing with the issues addressed above. This overview covers existing models on the experience of self-agency – i.e.,

motor prediction model and inference model—, and focuses on recent advances in studying the inferential nature of self-agency experiences, including the work reported in this dissertation in Chapters 3 to 5. Chapter 2 also includes a general discussion that addresses the potential implications and future directions of the present research on experienced self-agency.

Chapter 3 – Prime and probability: Causal knowledge affects inferential and predictive effects on self-agency experiences (van der Weiden, Aarts, & Ruys, 2011). In this chapter, the role of causal knowledge about action-outcome relations in experiences of self-agency is examined. This examination serves to reveal the combined contribution of motor predictions and cognitive inferences to experiences of self-agency, *and* to test the effect of causal knowledge on inferential priming effects on self-agency that have been shown to occur in the absence of actual action execution. To test the role of causal knowledge, action-outcome relations were manipulated in a learning phase, after which experienced self-agency over the same or over other outcomes was measured. The hypothesis was that motor predictions and cognitive inferences independently contribute to the experience of self-agency. Motor prediction effects were expected to occur only when relevant actions and outcomes are learned to be causally related, whereas cognitive inference effects were expected to occur also when no relevant causal knowledge is acquired. Importantly, it was further expected that when relevant actions and outcomes are learned *not* to be causally related, inferential priming effects on experienced self-agency disappear.

Chapter 4 – Reflecting on the action or its outcome: Behavior representation level modulates high level outcome priming effects on self-agency experiences (van der Weiden, Aarts, & Ruys, 2010). This Chapter focuses on the influence of how people represent their behavior. In case of

intentional, goal-directed behavior, people inherently represent their behavior in terms of *why* they perform a certain action, that is, in terms of the overarching goal of an action. This raises the question whether representing one's behavior in terms of higher order outcomes is essential for the inference of self-agency, also when people do not have a goal to produce a specific outcome in mind. Three studies tested this idea, using different action-outcomes and different self-agency tasks, both measuring and manipulating the level at which people represent the task behavior. Experienced self-agency over action-outcomes was expected to be more pronounced as a result of outcome priming when behavior is represented in terms of outcomes (i.e., in terms of *why* an action is performed) rather than when behavior is represented in terms of actions (i.e., in terms of *how* an action is performed).

Chapter 5 – A matter of matching: How goals and primes affect self-agency experiences (van der Weiden, Ruys, & Aarts, 2012). In this final chapter, the effects of goals and primes on experiences of self-agency are directly compared. Previous research, including the research described in Chapters 3 and 4, suggests that outcome primes enhance experiences of self-agency in the same way goals do. Both goals and primes activate an outcome preview that enhances self-agency over outcomes that match this preview, as long as one has not learned that there is no causal relation between one's action and this outcome, and when behavior is represented in terms of this specific outcome. However, previous research has not taken into account that goals and primes may differ in their effects on experiences of self-agency over *mismatching* outcomes, because goals (in contrast to primes) engage unique control processes that may be especially important when outcomes mismatch these goals. Therefore, in three studies, the effects of goals and primes as sources of experienced self-agency were examined in the context of both matching and mismatching outcomes. In line with previous research, goals and primes were expected

to enhance experienced self-agency over matching outcomes. Importantly, however, goals were expected to decrease experienced self-agency over mismatching outcomes, since people generally expect their goal-directed actions to be successful. Yet, primes were expected to increase experienced self-agency over mismatching outcomes to the extent that an actual outcome was associated with, and activated by, a primed outcome.

It is important to note in advance that each of the chapters of this dissertation is based on an article that has been submitted for publication or was published in a scientific journal. This means that the chapters are written in such a way that they can be read independently and in any order. Furthermore, Chapter 2 presents an overview and a general discussion of the empirical findings that are presented in more detail in Chapters 3 to 5. As a result, there exists some overlap between different parts of this dissertation.

CHAPTER 2

On The Nature of Experiencing Self-Agency: Inferring Oneself as the Cause of Intended and Unintended Outcomes

People often find themselves in situations where the cause of events is ambiguous. Surprisingly though, the experience of self-agency, i.e. perceiving oneself as the causal agent of behavioral outcomes, appears quite natural to most people. How then do these experiences arise? We discuss common models proposing that self-agency experiences result from the comparison between actual action-outcomes and the outcomes previewed in one's mind. These models emphasize the role of goals as the source of these previews. However, recent developments in psychology and neuroscience suggest that our behaviors and the outcomes they produce can be triggered and guided by environmental cues, and yet that people experience self-agency over these unintended outcomes. Hence, we also review recent research revealing how self-agency experiences over unintended outcomes arise and how the inferential processes underlying these self-agency experiences may differ from self-agency experiences resulting from goal-directed processes. Finally, directions for future research are briefly addressed.

Based on: van der Weiden, A., Aarts, H., & Ruys, K. I. (submitted). On The Nature of Experiencing Self-Agency: Inferring Oneself as the Cause of Intended and Unintended Outcomes.

In daily life people perform numerous actions that can each have multiple consequences. They perform these actions in contexts where others perform actions and cause action-outcomes as well. Hence, it is sometimes hard to tell whether one caused a certain outcome by one's own action, or whether someone else did. As a consequence, people sometimes experience self-agency over outcomes they did not cause, whereas other times they experience no self-agency over outcomes they did cause. For example, one may experience having caused the elevator to move down to one's floor after having pressed the button, whereas in actuality someone already inside the elevator caused the elevator to descend. Similarly, one may end up in an argument with someone, but experience no causation in upsetting the other person.

Over the last 40 years, research on causal attribution has shown that when reflecting on the possible cause of an outcome, people convey biases as a function of both outcome expectancies and motivation. That is, people are inclined to attribute causation over successful outcomes to themselves and unsuccessful outcomes to other causes (see for a review Shepperd, Malone, & Sweeny, 2008). However, much less attention has been devoted to experiences of self-agency during action performance and the observation of behavioral outcomes, that is, when execution and awareness of behavior co-occur in close proximity.

Although such on-line experiences of self-agency may very well be biased too, they are quite pervasive and appear very natural to most people. Humans already develop a sense of agency in early infancy, enabling them to distinguish the outcomes of their own actions from those of others (e.g., Brownell & Carriger, 1990; Decety & Chaminade, 2003; Piaget, 1954; Rochat & Striano, 2000). The experience of self-agency is important for a sense of control over the environment, and for how people perceive themselves and interact with others (e.g., Walker, Kestler, Bollini,

& Hochman, 2004; Wegner, 2002). The basic nature and fluency of establishing self-agency experiences in our social environment is intriguing and raises questions as to when and how such experiences emerge.

Based on theory and research on the role of priming and knowledge accessibility in modulating social cognition and behavior (e.g., Förster, Liberman, & Friedman, 2007; Higgins, 1996), on-line experiences of self-agency are generally assumed to occur when the outcome of one's action matches the outcome one had in mind. Such outcome previews are commonly thought to derive from people's intentions, i.e., conscious action plans directed at the attainment of desired outcomes, or goals. Thus, goals are central to agency as part of the process underlying goal achievement (e.g., Blakemore, Wolpert, & Frith, 2002; van der Weiden, Ruys, & Aarts, 2012). However, recent research indicates that people are not always aware of the actual causes of their behavior, including goals (e.g., Bargh, Gollwitzer, & Oettingen, 2010; Custers & Aarts, 2010; see also Nisbett & Wilson, 1977). How, then, can people have these pervasive agency experiences if their behavior starts outside conscious awareness? A possible answer to this question is that agency experiences do not only arise from our consciously set goals but also accompany nonconsciously triggered behavior and their observable outcomes, leading people to believe that they caused outcomes that were actually not intended, or planned.

This paper addresses how people establish a sense of self-agency over both intended and unintended outcomes. Specifically, we will examine the role of perceived causality between actions and outcomes, and the way people represent their behavior when inferring self-agency experiences over unintended outcomes. Importantly, we will also address new insights into the relation between self-agency experiences arising in the absence of a goal to produce a specific outcome and self-agency

experiences resulting from goal-directed processes. Finally, following up on these recent insights, we will elaborate on directions for future research.

An Intentional Stance toward the Emergence of Self-Agency Experiences

Only recently, researchers have begun to explore how experiences of self-agency arise. Generally, the experience of self-agency is considered to emerge when an action-outcome matches one's prior intention (e.g., Pacherie, 2008; Synofzik, Vosgerau, & Newen, 2008; Wegner & Wheatley, 1999). Whether one simply moves one's finger, flips a switch, or turns on the light, one experiences self-agency when the outcome of one's action corresponds with the outcome one intended to realize. Accordingly, initial models on self-agency emphasized the *relation* between actions and outcomes by proposing that the experience of self-agency results from sensorimotor outcome predictions that are made during action performance (Frith & Done, 1989).

Motor Predictions Underlying the Emergence of Self-Agency Experiences

When performing an action (e.g., moving one's fingers) that is intended to produce a specific outcome (e.g., grab a cup of coffee), the motor control system predicts the sensory consequences of that action (e.g., the amount of pressure needed to grab the cup; e.g., Wolpert & Flanagan, 2001). These motor predictions are then compared to the actual sensory outcomes of action, producing a sense of self-agency when the predicted and the actual sensory outcome match. This way, sensory feedback derived from motor signals serves as input for the sense of agency.

Interestingly, the association between actions and outcomes as produced by these comparisons at the sensorimotor level (Frith, Blakemore, & Wolpert, 2000a) causes systematic distortions in the temporal experience of voluntary movements (see for a review Moore & Obhi, 2012). For instance, when individuals voluntarily press a key that causes a tone 250 ms later, they judge the key press to occur later and/or the tone to occur earlier than when the two events occur alone. This temporal binding effect does not appear when the tone is preceded by an involuntary key press (e.g., resulting from transcranial magnetic stimulation; Haggard, Clark, & Kalogeras, 2002), or for tones produced by another person's actions (Engbert, Wohlschläger, & Haggard, 2008). Accordingly, the motor system is most likely to predict sensory outcomes in case of self-produced intentional movement (e.g., when intending to produce the tone by a key-press). Temporal binding between actions and outcomes therefore is a key component of people's feelings of agency over voluntary actions.

Although the motor prediction account of self-agency provides an interesting framework for understanding experiences of self-agency, it does not easily explain how people can experience self-agency in the absence of action execution or motor predictability. That is, people can also experience self-agency over unpredictable outcomes (e.g., Moore & Haggard, 2008; van der Weiden, Aarts, & Ruys, 2011) and over outcomes resulting from involuntary self-movements (e.g., Dogge, Schaap, Custers, Wegner, & Aarts, 2012; Moore, Wegner, & Haggard, 2009) or movements of others (Wegner, Sparrow, & Winerman, 2004). Furthermore, even when voluntary actions lead to predictable outcomes, people cannot always rely on motor predictions to arrive at the experience that *they* (rather than someone else) caused a certain event. Rather, in such social ambiguous situations, they also include conceptual interpretative agency cues such as knowledge about action-outcomes (e.g., Synofzik et al., 2008). In such

cases the on-line experience of self-agency may be an inference that occurs perfunctorily after action performance as a result of pre-activated outcome-related cognitions.

Cognitive Inferences Underlying the Emergence of Self-Agency Experiences

According to the inference account of self-agency (Wegner, 2002), and in line with other cognitive approaches to the emergence of self-agency experiences (such as Pacherie's (2008) conceptual model of the phenomenology of action), people tend to infer self-agency when an outcome corresponds with the outcome they had in mind. Often, people have a specific outcome in mind because they intend to produce this outcome. One is likely to think about a light being turned on when one wants to turn on a light, for instance.

However, people can experience self-agency even when they are not aware of their own goals or have no prior goals at all. In fact, considering how much of human behavior seems to be instigated and regulated outside of conscious awareness (e.g., Bargh & Chartrand, 1999; Custers & Aarts, 2010; Dijksterhuis & Bargh, 2001; Fourneret & Jeannerod, 1998; Moskowitz, 2002; Soon, Brass, Heinze, & Haynes, 2008), the mind seems to be designed to produce experiences of self-agency even over outcomes that people did not intend to obtain. Specifically, based on the notion that experiences of self-agency follow from a match between the actual outcome and the outcome one had in mind, the idea was brought up that people may also experience self-agency when the representation of an action-outcome is merely pre-activated in their mind.

In a first test of this idea, Wegner and Wheatley (1999) designed an experiment in which participants together with a confederate were asked

to move a square board that was mounted atop a computer mouse in slow sweeping circles. This movement led the cursor to move around 50 small objects (e.g., car, swan) that were displayed on a computer screen. After 30 seconds of moving, the participants heard music through their head phones They were instructed to stop moving a few seconds after the music began. Importantly, either 30 seconds, 5 seconds, or 1 second before the stop, subjects heard names of items that were either displayed on the screen or not. This rendered representations of possible outcomes of stopping the movement accessible in mind. Crucially, on some prime trials, the confederate received instructions over the headphone to force the cursor to stop on the primed item (producing a match between prime and outcome). After each stop participants indicated the extent to which they felt to have caused the stop. In line with the general decay function of covert priming effects in perception and cognition (e.g., McKone, 1995), results showed that experienced control over forced stops was higher when the prime appeared either 5 or 1 s, rather than 30 s, before the stop. Interestingly, on trials where stopping was not forced, priming did not cause participants to stop on the primed item, indicating that outcome priming can create the illusion of self-agency over outcomes that are in actuality produced by another agent.

These priming effects have been replicated with different priming durations (either consciously perceivable or too brief to be consciously perceived), across different tasks using a variety of actions and outcomes such as stopping a moving square on a specific location, watching vicarious limb movements, or causing other people's emotions (Belayachi & Van der Linden, 2010; Gentsch & Schütz-Bosbach, 2011; Jones, de-Wit, Fernyhough, & Meins, 2008; Linser & Goschke, 2007; Ruys & Aarts, 2012; van der Weiden, Aarts, & Ruys, 2010; Wegner et al., 2004; Wegner & Wheatley, 1999), and across different cultures (Aarts, Oikawa, & Oikawa, 2010; Sato, 2009). Importantly, these converging findings suggest

that people experience self-agency when the outcome of their action matches the outcome that they have in mind, irrespective of the source of the pre-activated outcome representation (an explicit goal or an implicit prime).

An important asset of the inferential approach is that, in contrast to the motor prediction approach, it can explain the emergence of self-agency experiences in situations where there is no action execution or sensorimotor outcome predictability. In that case, the experience of self-agency "… arises from processes that are psychologically and anatomically distinct from the processes whereby mind creates action" (Wegner, 2002, p. 29). Thus while actions are guided by motor control processes that inform the sense of agency via sensorimotor predictions, experiences of self-agency may further be built on pre-activated outcome representations that serve as input for inferences of self-agency. Hence, cues that activate relevant outcome information can give rise to self-agency experiences in situations where motor prediction signals are absent or uninformative, e.g., when people have no prior knowledge about the causal relation between specific actions and outcomes (van der Weiden et al., 2011).

In sum, research so far has convincingly shown that people infer self-agency from their conscious goals to engage in behavior. Furthermore, researchers have begun to explore how experiences of self-agency over unintended outcomes emerge. In both cases, people infer agency when pre-activated and actual action-outcomes match. At first glance, then, it seems that the same matching process induces inferences of self-agency over both intended and unintended outcomes.

More recently, though, research has zoomed in on the mechanism underlying this matching process and has provided new insights on *when*

and *how* inferential experiences of self-agency emerge over unintended outcomes. Specifically, this research addresses the role of perceived causality and the way people represent their behavior in inferences of self-agency. Furthermore, it also reveals how the experience of self-agency resulting from unconscious sources may differ from the experience of self-agency resulting from goal-directed sources. In the following sections we will review these recent developments in more detail.

Perceived Causality and Inferential Experiences of Self-Agency

Although previous studies demonstrate that inferences of self-agency over action-outcomes follow from the pre-activation of outcome-relevant information, there are also boundary conditions to these priming effects. The theory of apparent mental causation advocates that for experiences of self-agency to emerge, the perceived (rather than actual) causal relation between actions and outcomes is central (Wegner, 2002). Whether people perceive causal relations between events (e.g., actions and outcomes) in turn depends on three principles: priority, consistency, and exclusivity (Einhorn & Hogarth, 1986; Gilbert, 1998; Kelly, 1972; McClure, 1998; Wegner, 2002). That is, people perceive a causal relation between actions and outcomes when they had a preview (priority) of the corresponding (consistency) outcome of an action, especially when there is no other likely cause (exclusivity) of the outcome. Hence, if people only experience self-agency over an outcome when they can pinpoint a likely cause of the outcome, they should especially experience self-agency over outcomes that are consistent with the action they performed (see also Wenke, Fleming, & Haggard, 2010). This notion forms an essential part in models of goal-directed behavior, in which an agent is proposed to act on knowledge about which actions are instrumental in attaining one's goal (e.g., Aarts & Elliot, 2012; Dickinson & Shanks, 1995).

However, it has been demonstrated that actual action execution is not necessary for people to infer self-agency over outcomes that have been primed (e.g., Wegner, 2002; Wegner, et al., 2004). This suggests that knowledge about the relation between actions and outcomes, or causality in general, is much less of an issue when experiences of self-agency result from mere outcome priming. Yet, under normal circumstances, it would still be odd to experience having caused an outcome when knowing from experience that the action one performs cannot cause the outcome (e.g., when pushing the ENTER-button is followed by rainfall). Indeed, there is evidence suggesting that perceived causality is a boundary condition for the experience of self-agency, also in case of unintended outcomes: When people are primed with an outcome representation *after* action-performance, which violates the priority principle of perceived causation, experienced self-agency is not enhanced (Wegner & Wheatley, 1999).

More evidence comes from recent studies that examined the effect of outcome predictability on inferences of self-agency (Sato, 2009; van der Weiden et al., 2011). In one study (van der Weiden et al., 2011), participants repeatedly performed actions (i.e., a left or a right key press) that produced one of two outcomes (e.g., the words 'book' and 'glass' presented on the computer-screen). Importantly, the probability by which actions and outcomes co-occurred was manipulated (either 50% or 80% co-occurrence) which allowed participants to acquire knowledge about the (causal) relation of the actions and outcomes. Next, subjects engaged in a self-agency task where outcomes were primed before they repeatedly performed one of the two actions and observed the outcomes. Results showed that outcome priming enhanced experiences of self-agency when actions and outcomes were learned to be causally related (80% co-occurrence). However, when the relevant actions and outcomes were learned *not* to be causally related (50% co-occurrence), experiences of self-agency were not affected by outcome priming (see also Sato, 2009).

Interestingly, however, when the acquired causal knowledge about action-outcome relations was irrelevant to the outcomes over which self-agency was assessed, outcome priming still enhanced experienced self-agency.

These findings indicate that perceived causality is a key determinant of outcome priming effects on experiences of self-agency. These findings also converge with research showing that when perceived causality between own actions and resulting outcomes is obstructed (i.e., when another cause obviously produces the outcomes and hence the exclusivity principle is violated), people do no longer experience self-agency over the outcomes (Buehner & Humphreys, 2009). Moreover, the observation that priming enhances self-agency when no relevant causal knowledge is acquired offers an account for previous findings showing that priming increases self-agency even when the outcome is not predictable.

Prior learning of causal action-outcome relations thus plays an essential role in inferences of self-agency. Perceived causality may further be affected by impressions or beliefs that do not result from direct learning experiences. For example, people who believe that their behavior is self-caused rather than pre-determined (e.g., by higher powers, natural laws, or random factors) may be more inclined to perceive a causal relation between their own behavior and the outcomes that follow, and hence, may be more sensitive to outcome primes when inferring self-agency (Aarts & Van den Bos, 2011; Desantis, Roussel, & Waszak, 2011; Dogge et al., 2012; Moore, Wegner, & Haggard, 2009).

To summarize, perceived causality, which is affected by the consistency between actions and outcomes, forms a crucial boundary condition to inferential priming effects on experienced self-agency. When performing an action, people only experience self-agency over a subsequent (primed) outcome if they consider their action to be a potential

cause of the outcome that follows. In other words, people only infer self-agency over an outcome if they represent their actions and outcomes in terms of cause and effect.

Behavior Representations and Inferential Experiences of Self-Agency

In addition to the notion that perceived causality modulates effects of the mere activation of outcome representations on people's experiences of self-agency, there is evidence that further suggests that the *way* people represent their behavior also plays a central role in the mechanism underlying inferences of self-agency (Pacherie, 2008; van der Weiden et al., 2010). In the case of goal-directed behavior, people inherently represent their behavior in terms of why they perform a certain action, i.e., in terms of the desired outcome or goal of an action. For example if one has the goal to turn on the light, one most likely represents the behavior of manually operating a light switch in terms of 'turning on the light'. The same behavior of manually operating a light-switch, however, can also be represented in terms of 'moving one's finger', or 'flipping the light switch'. Hence, when behavior is triggered and executed in the absence of a goal to produce a specific outcome, the level at which people represent their behavior may be much more variable. One may thus wonder whether people have to represent their behavior in terms of outcomes in order to infer self-agency over outcomes. Rather than depending on an objective comparison between an actual and primed outcome, then, the extent to which primes and actual outcomes are perceived to match may be a matter of subjectivity.

The notion that behavior can be represented at different levels has been proposed by several models and theories dealing with the cognitive architecture and control of behavior (e.g., Aarts & Dijksterhuis, 2000; Gallistel, 1985; Jeannerod, 2006; Powers, 1973; Vallacher & Wegner,

1987). For instance, behavior representation levels play an important role in the understanding of behavior (Aarts & Hassin, 2005; Kozak, Marsh, & Wegner, 2006; Vallacher & Wegner, 1989; Wegner, Vallacher, Macomber, Wood, & Arps, 1984). According to Action Identification Theory (Vallacher & Wegner, 1987; Wegner & Vallacher, 1986), any behavior can be identified at multiple levels. People who represent their behavior at a low level define their behavior in terms of *how* an action is done, whereas people who represent their behavior at a higher level define their behavior in terms of *why* an action is done. As a consequence, what is considered to be the outcome of behavior depends on the level at which the behavior is represented. People who represent their behavior at a low level generally perceive their behavior in terms of producing sensorimotor outcomes (a low level outcome), whereas people who represent their behavior at a high level generally perceive their behavior in terms of serving an overarching goal or outcome (a high level outcome).

The level at which people represent their behavior has been suggested to play an important role in the matching process underlying the experience of self-agency (Pacherie, 2008). Whether people represent the outcomes of their actions in terms of moving one's finger, flipping the light switch, or illuminating a room crucially determines whether they perceive the outcome of an action to match a pre-activated outcome representation, and hence, whether they infer self-agency over the outcome. In other words, the level of behavior representation can moderate outcome priming effects on self-agency inferences in situations where people do not have an explicit goal to attain a specific outcome.

In a recent study that examined this idea (van der Weiden et al., 2010), participants performed the wheel of fortune task (Aarts et al., 2005). This task requires participants to stop the movement of a square rapidly traversing a rectangular path consisting of eight tiles (see Figure 2.1). At

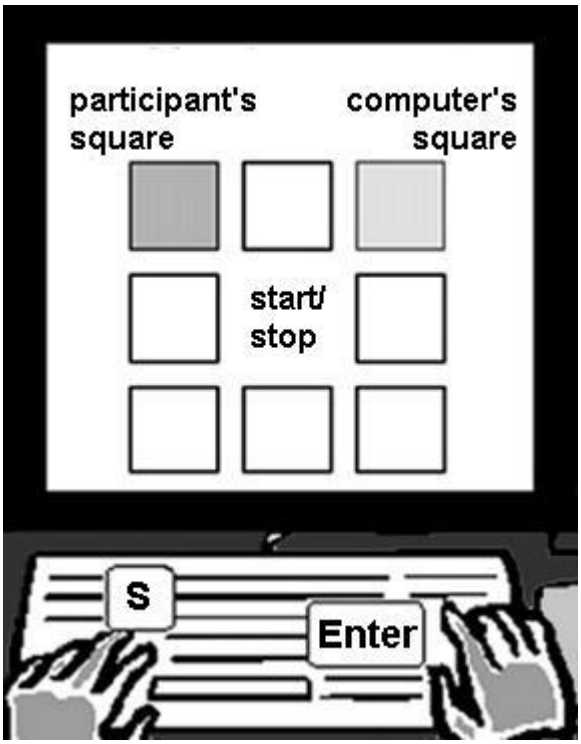

Figure 2.1. Visualization of the wheel of fortune task, adapted from Aarts, Custers, & Wegner, 2005.

the same time, however, the computer also moves a square along the path in opposite direction. Once participants stop their moving square, they are presented with the stop location of only one of the squares. This location thus represents the stop location of either their own square or the computer's square, rendering the cause of the outcome ambiguous. On each trial, participants indicate the extent to which they feel that they caused the square to stop at the presented location. The experiment contained two manipulations. First, each participant was either primed with the corresponding outcome (stopped location) or not, just before they had to stop the movement of the square. Second, participants' behavior representation level was manipulated by emphasizing different task aspects. For half of the participants the instructions emphasized that the

task was about pressing the enter button when the stop cue appeared (emphasizing how the action is done; a low level behavior representation). For the other participants the instructions emphasized that the task was about determining where the square would stop after pressing the enter button (emphasizing why the action is done; a high level behavior representation).

Results showed that priming the square's stop location (i.e., a high level outcome representation) enhanced experiences of self-agency when participants represented their behavior at a correspondingly high level (i.e., in terms of stopping the square on a specific location) rather than a lower level (i.e., in terms of pushing a button). Further experimentation showed that this moderating role of behavior representation in priming effects on experienced self-agency also occurs as a function of individual variations in level of behavior representation (van der Weiden et al., 2010). This finding illustrates that consistency between primed and actual outcomes is not sufficient to affect experiences of self-agency. Primed outcomes should also correspond with the level at which a person represents his or her own behavior.

Similar to experiences of self-agency arising from goal-directed behavior, then, outcome priming mainly enhances experienced self-agency when people consider *why* they perform a certain action and not (or less) when they attend to *how* that action should be performed (van der Weiden et al., 2011). This renders the matching process underlying inferences of self-agency over unintended outcomes susceptible to a variety of factors. That is, the level at which people represent their behavior, and hence the experience of self-agency, depends on many contextual and individual factors. Both task difficulty and failure, for instance, cause people to focus on lower level representations: "How should this action be executed?", or "How to accomplish this task successfully in the future?" (Dannenberg,

Förster, & Jostmann, 2012; Vallacher & Wegner, 1987, 1989). Also, people who tend to act on their impulses are likely to represent their behavior at a relatively *low* level, because they are *less* inclined to think about the consequences of their behavior (Martin & Potts, 2009; Vallacher & Wegner, 1989). Conversely, people who believe in free will (rather than determinism), are likely to represent their behavior at a relatively *high* level, because they are *more* inclined to think about the consequences of their behavior (Vohs & Schooler, 2008).

Goals versus Mere Outcome Representations as Sources of Self-Agency Inferences

The research on outcome priming effects on self-agency inferences discussed so far suggests that the process by which primes enhance self-agency experiences is identical to the process underlying self-agency experiences associated with goal-directed behavior. People infer self-agency when they perceive a causal relation between their mental preview of a higher level outcome and the actual outcome, irrespective of whether this preview is induced by an explicit goal or an implicit prime. In line with this notion, goals and outcome primes have been shown to enhance experiences of self-agency over outcomes that match these goals and primes to the same extent (Aarts et al., 2005). Thus, goals do not seem to make self-agency experiences more special than do mere previews of action-outcomes.

Yet, although outcome priming effects on the enhancement of experienced self-agency mimic the effects of goals, this does not necessarily suggest that primes affect agency processing in the same way as goals do. Because the way people represent and control their behavior plays a crucial role in the emergence of self-agency experiences, whether an outcome representation is activated by one's own intention or an

external cue may also play an important role in the emergence of self-agency experiences. While outcome primes mainly render the representation of the outcome accessible, goals evoke specific control processes that deal with shielding, monitoring and feedback processing in the service of attaining the specific desired outcome (e.g., Carver & Scheier, 1998; Moskowitz, Li, & Kirk, 2004), processes that may be especially important when outcomes mismatch one's goal. Indeed, recent research that examined experiences of self-agency over both matching and mismatching outcomes revealed that goals and outcome primes affect self-agency through different mechanisms (van der Weiden et al., 2012).

In this research, participants performed an adapted version of the wheel of fortune task. Instead of measuring experienced self-agency only over matching outcomes, experienced self-agency over mismatching outcomes was also assessed. On matching trials, the square's stop location was the same location participants were primed with or intended to stop their square. On mismatching trials the spatial distance between outcomes and goals and primes was systematically varied (i.e., 1, 2, 3, or 4 locations distance; see also Figure 2.1). Results showed that the extent to which actual outcomes mismatched was associated with different decrease patterns of experienced self-agency as a function of whether participants had a goal to produce a specific outcome or whether they were merely primed with the outcome. Experienced self-agency dropped instantly and remained low when an outcome mismatched a goal, regardless of the distance between the actual and intended outcome. In case of outcome priming, however, experienced self-agency decreased more gradually as a function of the distance between the actual outcome and the primed outcome (see Figure 2.2).

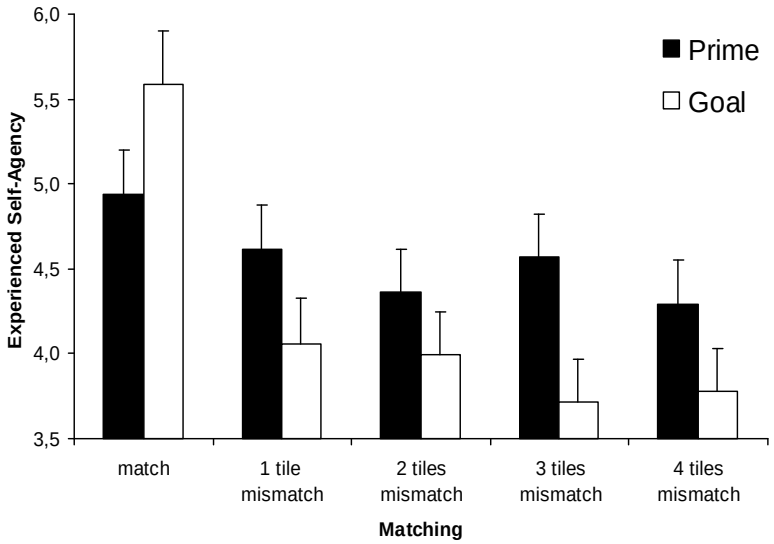

Figure 2.2. Experienced self-agency over outcomes that mismatched to an increasing degree with either a goal or a prime. Error bars represent standard errors of the means.

These results provide first evidence for the idea that experiences of self-agency as produced by goals versus outcome primes take on a different form and quality: Goals affect the inferential process of self-agency by focusing people's attention on one specific outcome (i.e. the goal), and by incorporating both matching and mismatching outcome information. Outcome priming, on the other hand, affects self-agency via an inferential process that is open to associative processing of related (e.g., spatially close) outcome information and that incorporates matching outcome information only. Accordingly, goals reduce self-agency over mismatching outcomes whereas outcome primes do not affect self-agency over mismatching outcomes, but in fact even enhance self-agency over mismatching proximate outcomes.

Conclusion and General Discussion

The experience of self-agency is an exciting and important topic for the understanding and examination of human self-perception and volition. Research in this field suggests that self-agency arises from both sensorimotor predictions that originate from people's intentions and retrospective inferences that result from previews of action-outcomes. Here, we mainly examined the inferential processes underlying self-agency experiences and explored a few key-aspects that modulate the effects of outcome previews on experienced self-agency, such as the perceived causality between action and outcome and the level at which people represent their behavior. Furthermore, we highlighted recent research showing differences in experienced self-agency resulting from inferences that we draw from our purposes to engage in behavior (i.e. goals), and from inferences that originate from primes that implicitly cause us to presage an outcome before it occurs.

The study on the inference of self-agency is particularly interesting from a social perspective since our actions can have multiple consequences while, at the same time, other agents might also have caused these outcomes in our environment. In such ambiguous situations, inferences of self-agency leave room for biases in the perception of one's own behavior. Hence, cues that refer to outcome information of actions are likely candidates to bias the agency ascription process. Importantly, in most of the studies we discussed, participants had no actual control over the outcomes. This allowed the researchers to assess the extent to which experienced self-agency is augmented or weakened as a result of matches or mismatches, independent of effects of actual control. The general gist of this research is that people tend to over-attribute causation to themselves when an action-outcome matches with the outcome that is primed or set as a goal. Only when people have a goal in mind, biases in experienced self-

agency unfold in the other direction. That is, people may under-attribute causation to themselves (and over-attribute causation to other causes) over outcomes that mismatch their goal. Thus, whereas priming mainly biases agency ascription to the self, goals (in the case of failure) also bias agency ascription to others. We briefly address a few implications of these findings for future research.

Agency and motivation. The finding that experiences of self-agency over mismatching outcomes are only reduced in the context of goal-directed behavior may have consequences for human motivation and self-regulation. In line with research in the area of self-attribution, one likely reason why goals are attuned to both successful and unsuccessful outcomes is that success and failure are key aspects of learning, decision making, motivation, and performance in the service of goal attainment (Aarts & Elliot, 2012). Importantly, research suggests that success and failure affect motivation and goal-directed performance only when people attribute the successful or unsuccessful outcomes at hand to themselves (e.g., Neumann, 2000; Steinhauser & Kiesel, 2011). Thus, agency and motivation seem to be interrelated in the context of goal-directed behavior. Interestingly, then, the observation that the source of outcome pre-activation (e.g., prime vs. goal) differentially affects self-agency experiences also opens new avenues for research on how different *goal-directed* sources affect self-agency experiences and downstream consequences for motivation.

One such avenue concerns the issue of whether it matters whether goals are self-chosen or externally assigned. An extensive body of research on goal setting and self-determination has shown that people become more motivated after success when they have chosen their own goal, compared to when they are assigned a certain goal (e.g., Patall, Cooper, & Robinson, 2008; Deci & Ryan, 2000). Consequently, if agency and motivation are

directly related, people should also experience more self-agency over the attainment of self-chosen goals rather than assigned goals.

However, self-agency experiences are suggested to rely on a cognitive matching process that is crucially affected by goal-directed control processes (Wegner, 2002; van der Weiden et al., 2012). Because self-chosen as well as assigned goals instigate similar control processes that support goal attainment (Aarts & Elliot, 2012), it follows that self-chosen and assigned goals may have similar effects on self-agency. If this is indeed the case, the hypothesis that effects of choice on motivation are mediated by experienced self-agency becomes unlikely. In other words, although success and failure may often alter agency and motivation in a similar fashion, agency and motivation may not necessarily be related (cf. research on unconscious motivation effects on decision making and performance; Bargh et al., 2010; Custers & Aarts, 2010). This argumentation is of course speculative and awaits future testing.

Internal versus external sources of agency. In the majority of studies on experienced agency, the focus has been on the distinction between self versus other agency. Yet, whereas the attribution of causality to external agents may decrease experienced self-agency (cf, an agentic shift; Milgram, 1963), there may also be situations in which people experience self-agency over outcomes that obviously resulted from the behaviors of others. From this perspective, two social instances are relevant to explore in further detail.

First, merely watching other people perform actions activates corresponding motor areas in the observer's brain through so-called mirror neurons (Decety, Chaminade, Grèzes, & Meltzoff, 2002; Fadiga, Fogassi, Pavesi, & Rizzolatti, 1995; Rizzolatti & Craighero, 2004). When performing actions together with others, people often even include others'

actions in their own action repertoire, assuring smooth joint actions (e.g., Obhi & Sebanz, 2011; Sebanz, Bekkering, & Knoblich, 2006; Ruys & Aarts, 2010). Remarkably, people occasionally also include other agents in their *self*-representation, for example when they identify strongly with other in-group members (e.g., Brewer & Gardner, 1996; Tropp & Wright, 2001). Consequently, people may experience self-agency over the outcomes of other people's actions because they feel like their own actions. Perceiving the actions of others as one's own has important implications for perspective taking and empathy, for example causing people to become distressed by the distress of others (Decety & Chaminade, 2003) and to feel guilty for the wrongdoing of others (Lickel, Schmader, Curtis, Scarnier, & Ames, 2005). As the observation and representation of other people's behavior likely provides people with relevant outcome previews, the inference process of experienced self-agency addressed here may provide an account for such vicarious agency effects (cf. Wegner et al., 2004).

The second instance pertains to when one's own goals are influenced by others, especially when one is unaware of such influence. As recent research suggests, in one's social environment one's goal-directed behavior is regularly affected by what other people do and seem to find interesting (Aarts & Hassin, 2005; Ackerman, Goldstein, Shapiro, & Bargh, 2009; Bar Anan, Wilson, & Hassin, 2010; Dik & Aarts, 2007; Fitzsimons & Finkel, 2010; Friedman, Deci, Elliot, Moller, & Aarts, 2010; Lebreton, Kawa, d'Arc, Daunizeau, & Pessiglione, 2012; Loersch, Aarts, Payne, & Jefferis, 2008). This direct social influence on goal setting and pursuit is not limited to exposure to narratives, physical movements, or object-oriented actions of other people, but also occurs for more subtle behavior, such as eye-gaze or emotional facial expressions (Bayliss, Frischen, Fenske, & Tipper, 2007; van der Weiden, Veling, & Aarts, 2010). Whereas the sharing of goals can be beneficial for social

functioning (Tomasello & Carpenter, 2007), it raises the important and intriguing question of how one arrives at the experience of self-agency when goal-directed behavior is the mere product of social influence. It may be the case that goals that are automatically induced by the behavior of others function as outcome primes, or alternatively, affect experienced self-agency in the same way consciously self-chosen or assigned goals do. Future research could explore this issue by investigating the effect of matches and mismatches on experienced self-agency.

Concluding Remarks

Most people experience self-agency over their behavior. These agency experiences arise when previewed and actual behavioral outcomes co-occur in close proximity. Essentially, experiences of self-agency inform us that we cause our own actions and resulting outcomes: It is I who is doing it. Whereas the experience of agency often appears natural to us, a closer look at the topic indicates that there are many situations where the establishment of agency is not a straightforward affair (e.g., when there are other potential causes, or when we are unaware of the goals we pursue). The study of self-agency experiences is still in its infancy, and deserves more theoretical and empirical attention to enhance our understanding of how we perceive ourselves and how we perceive and interact with other selves (e.g., Walker et al., 2004; Wegner, 2002).

CHAPTER 3

Prime and Probability: Causal Knowledge Affects Inferential and Predictive Effects on Self-Agency Experiences

Experiences of having caused a certain outcome may arise from motor predictions based on action-outcome probabilities and causal inferences based on pre-activated outcome representations. However, when and how both indicators combine to affect such self-agency experiences is still unclear. Based on previous research on prediction and inference effects on self-agency, we propose that their (combined) contribution crucially depends on whether people have knowledge about the causal relation between actions and outcomes that is relevant to subsequent self-agency experiences. Therefore, we manipulated causal knowledge that was either relevant or irrelevant by varying the probability of co-occurrence (50% or 80%) of specific actions and outcomes. Afterwards, we measured self-agency experiences in an action-outcome task where outcomes were primed or not. Results showed that motor prediction only affected self-agency when relevant actions and outcomes were learned to be causally related. Interestingly, however, inference effects also occurred when no relevant causal knowledge was acquired.

Based on: 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.

In most humans, the performance of behavior is often accompanied by a sense of self-agency, that is, the experience of causing one's own actions and resulting outcomes. These experiences arise under conditions in which the cause of outcomes is clear, such as when one knows that one's own action leads to the outcome, but also when self-causation is more ambiguous, such as when the outcome may occur independently of one's own action. Accordingly, the literature distinguishes two main processes that contribute to experiences of self-agency (e.g., Moore & Haggard, 2008; Moore, Lagnado, Deal, & Haggard, 2009). First, experiences of self-agency depend on the extent to which our motor control system is able to predict the sensory outcome that is produced by performing a specific action. Second, self-agency can be cognitively inferred, based on whether the outcome corresponds with the outcome one had in mind.

So far, however, research has not clearly addressed when and how motor predictions and cognitive inferences combine to affect experiences of self-agency. Based on previous research on the effects of prediction and inference on self-agency (Sato, 2009), we propose that the influence of motor predictions and cognitive inferences on experiences of self-agency crucially depends on knowledge people have about the causal relation between actions and outcomes. Such causal knowledge refers to the information that a person has to assess the consequences of a specific action. Basically, this knowledge is obtained when the motor control system learns that the execution of a specific motor command leads to a specific sensory outcome. One can learn such a relation through direct performance of an action and subsequent observation of the outcome, but also through instruction if one is able to imagine or simulate the action and the outcome. Whereas the acquisition of causal knowledge of action-outcome relations is likely to be facilitated by conscious processes, as in case of mental imagery (e.g., Frith, Blakemore, & Wolpert, 2000a;

Jeannerod & Frak, 1999), recent work suggests that the learning of this knowledge may occur without conscious awareness (Custers & Aarts, 2011).

Once a person has acquired causal knowledge about a certain action-outcome relation, this knowledge may influence the effects of both motor predictions and cognitive inferences on people's experiences of self-agency over these action-outcomes (Synofzik, Vosgerau, & Newen, 2008). That is, when people know that actions and outcomes are causally related (e.g., due to a high probability of co-occurrence), both motor-predictive and cognitive-inferential processes affect self-agency (Moore & Haggard, 2008). However, knowing that specific actions and outcomes are not causally related prevents the contribution of both motor predictions and cognitive inferences to experiences of self-agency over these specific outcomes, since this knowledge informs people about whether they may have caused this outcome by their own action. Yet, if people do not have relevant knowledge about the causal relation between the specific action and outcome at hand, the motor control system cannot predict the sensory consequences of the action, whereas inferences may still augment the sense of agency when the outcome corresponds with the outcome presaged in one's mind. We report an experiment that tested this novel and intriguing idea.

Central to the motor prediction view on the emergence of self-agency is the relation between our actions and outcomes. When we perform a specific action (e.g., pushing a button) that is expected to produce a specific outcome (e.g., turning on a light), we do not only have knowledge and cognitions about their causal relation. Our motor control system also predicts the sensory consequences of that action (e.g., Blakemore, Wolpert, & Frith, 2002; Moore & Haggard, 2008). These motor prediction processes, in which predicted and actual sensory

outcomes are being compared, are crucial to regulate behavior. Furthermore, when a match is detected between the predicted and the actual outcome, we experience a sense of self-agency over causing the outcome. However, the absence of such a match weakens experiences of self-agency. Thus, the better the motor control system can predict the sensory consequences of a specific action, the more likely it becomes that the actual sensory outcome of an action matches the predicted sensory outcome and that one feels a sense of self-agency over producing this outcome. Hence, causal knowledge plays an important role in prediction effects on self-agency experiences (Moore & Haggard, 2008; Moore, Lagnado, et al., 2009).

In addition to motor predictability influences, research has shown that cognitive inferences play a key role in our experiences of self-agency. Specifically, this research shows that people tend to infer self-agency when an action-outcome corresponds with the outcome they had in mind (Wegner, 2002). Often, this inference effect results from the intention to produce a specific outcome. Interestingly, experiences of self-agency are also enhanced when people do not intend to produce a specific outcome, as long as a representation of the action-outcome is pre-activated in mind (e.g., Wegner & Wheatley, 1999). That is, (subliminal) priming of outcome representations before performing an action and observing the corresponding outcome also enhances people's experiences of self-agency (e.g., Aarts, Custers, & Wegner, 2005; Ruys & Aarts, 2012; Sato, 2009). These inference effects of outcome priming are suggested to occur independently of actual action execution or motor predictability and rely merely on pre-activated outcome representations (e.g., Wegner, 2002; Wegner, Sparrow, & Winerman, 2004). Thus, it seems that the relation between action and outcome does not play a role in the effect of causal inferences on self-agency experiences, thereby challenging the role of

causal knowledge about the relation between action and outcome in the establishment of self-agency experiences.

However, whereas people may experience agency over outcomes that they do not intend to produce or actually control, it could be questioned whether outcome priming always increases the experience of self-agency, or whether there are boundary conditions to this effect. One such boundary condition may occur when one has learned that one's action has no causal relation with the outcome. After all, under normal circumstances, it would be odd to experience your own action to be the cause of an outcome when one knows from experience that the action cannot have caused the outcome (e.g., when pushing the ENTER-button is followed by rainfall). Thus, when one has learned that one's action is causally related to the specific outcome, both motor predictions and cognitive inferences contribute to experiences of self-agency. However, learning that one's action is not causally related to the outcome may reduce the role of both predictive and inferential processes in the emergence of self-agency experiences (cf. Synofzik et al., 2008).

Suggestive evidence for this idea comes from a recent study that examined the combined effect of motor predictions and cognitive inferences on experienced self-agency (Sato, 2009). In this study, participants pressed a left or a right key to produce one out of two different outcomes (a blue or a red circle presented on the computer screen). These outcomes could be produced by the participant or by the computer. Prior to observing an outcome, a consistent (i.e., same color), neutral (i.e., a color unrelated word), or inconsistent (i.e., other color) outcome representation was primed. Causal knowledge of action-outcome relations was manipulated by varying the probability of the relation between actions and outcomes. That is, each of the two responses produced one particular color in 50% (no causal relation) or 75% (causal relation) of trials. Apart from a

general motor predictability effect, results showed that priming consistent outcomes only enhanced experienced self-agency (relative to priming neutral outcomes) when actions and outcomes were causally related (75%). This inferential priming effect disappeared when there was no causal relation between actions and outcomes (50%). These findings suggest that self-agency experiences followed from inferential processes only when participants learned that their actions were causally related to the outcomes, thus revealing a boundary condition of causal knowledge for outcome priming effects on experiences of self-agency.

In contrast to these findings, however, previous research has found inference effects of outcome priming on self-agency experiences in contexts where causal knowledge about action-outcome relations was absent (e.g., Aarts, Custers, & Marien, 2009; Aarts et al., 2005; Wegner & Wheatley, 1999). Clearly, in these situations the sense of agency cannot be derived from motor predictability processes. However, the fact that outcome priming augments the sense of agency in the absence of causal knowledge about the relation between action and outcomes suggests that it is important to understand when exactly causal knowledge forms a boundary condition for inferential processes to take place.

Specifically, what seems to matter is whether people have acquired knowledge about causal relations between actions and outcomes that is relevant for assessing whether their action may have caused the primed outcome. People are less likely to experience self-agency over primed outcomes when they know there is no causal relationship between these outcomes and the actions they perform (Sato, 2009). However, people may still infer self-agency over primed outcomes when they have no relevant knowledge regarding the specific causal relation between their actions and following outcomes (e.g., when no or irrelevant action-outcome relations are learned). This concurs with everyday experiences

suggesting that people can have a sense of self-agency over novel outcomes that result from their actions. The experiment reported below examined this crucial role of the presence of relevant causal knowledge about the relation between specific actions and outcomes in motor-predictive and cognitive inferential effects on experiences of self-agency.

Experiment 3.1

In the experiment, we first manipulated knowledge about the causal relation between actions and outcomes in a probability learning task. We then measured online self-agency experiences in a subsequent action-outcome task recently employed in research studying priming effects on self-agency experiences in a context where causation is ambiguous (Aarts et al., 2009; van der Weiden, Aarts, & Ruys, 2010, see Chapter 4 in this dissertation).

In the agency task, participants stop a rapidly presented sequence of letter strings that ostensibly masks the alternation of two words (‘glass’ and ‘book’), by pressing a left or a right key. In actuality no words are presented. Participants then observe that the sequence stops on one of the two 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 briefly primed with the corresponding word or not, just before they stop the sequence, observe the stopped word, and indicate experienced self-agency over stopping this word.

Crucially, before the self-agency task, participants first perform a probability learning task in which pressing a left or a right key is followed by one of two words. In two conditions, the words that followed participants’ actions were the same words as used in the subsequent agency-task. We therefore refer to these conditions as the agency-relevant

conditions. It is important to note that in both of these conditions, participants acquired knowledge about the causal relation between the actions they performed and the outcomes that followed in the agency-task. In one agency-relevant condition there was a causal relation between actions and outcomes (80% probability of co-occurrence), while in the other agency-relevant condition there was no causal relation between actions and outcomes (50% probability of co-occurrence). Additionally, we introduced a control condition in which participants did not gain causal knowledge about the relation between the actions they performed and the outcome words that were used in the subsequent agency-task. Instead, participants learned that pressing a left or a right key led to two other words ('soap' and 'chalk') with 50% probability. Thus, in this condition the knowledge that their actions and outcomes are not causally related is irrelevant to the action-outcomes in the agency-task (agency-irrelevant condition). This allowed us to assess the importance of the presence of relevant causal knowledge in prediction and inference effects on experienced self-agency. Furthermore, the control condition allowed us to separate the contribution of motor predictability and inferential priming effects in experiences of self-agency.

We expected that motor predictability and outcome priming both enhance experienced self-agency over action-outcomes. Furthermore, in line with previous work (Sato, 2009), we expected outcome priming to augment experienced self-agency when participants learned that there was a causal relation between actions and outcomes (80% agency-relevant condition), but not when participants learned there was no causal relation between actions and outcomes (50% agency-relevant condition). Importantly, if a non-causal relation is learned regarding irrelevant action–outcomes, and hence this knowledge is irrelevant for the outcomes of the self-agency task, then outcome priming effects should reemerge in the 50% agency-irrelevant condition. That is, in the 50% agency-irrelevant

condition participants have no prior knowledge about the specific causal relation between the actions they perform and the outcomes that follow in the agency task and therefore the motor predictive effects should not occur while the inferential effects of outcome priming should still show up.

Method

Participants and design

One-hundred-and-seven undergraduates participated in return for course credit or a small fee. In the self-agency task, all participants were presented with two types of trials: trials on which the outcome representation (the word that would be presented after the key press) was primed, and control trials without such primes. Knowledge about the causal relation between actions and outcomes was manipulated as a between-participants factor with three levels (80% agency-relevant, 50% agency-relevant, 50% agency-irrelevant).

Experimental task and procedure

Participants were seated behind a computer and worked individually on the tasks. After some introductions and practice with the self-agency task they moved on to two consecutive tasks: a probability learning task and a self-agency task.

Probability learning task. The experiment started with the probability learning task. In this task, participants repeatedly pressed a left or a right key in response to an arrow that pointed to the left or the right, and monitored how often the object words ‘book’ or ‘glass’ (or ‘soap’ or ‘chalk’ in the 50% agency-irrelevant condition) would follow (for similar probability manipulations, see Chatlosh, Neunaber, & Wasserman, 1985; Moore, Lagnado, et al., 2009). The objects were pre-tested to be neutral to

our sample of participants. In the 80% agency-relevant condition, participants learned that a specific action was more likely to produce a specific outcome. For example, pressing a left key produced ‘book’ with 80% probability and ‘glass’ with 20% probability, whereas pressing a right key produced ’glass’ with 80% probability and ‘book’ with 20% probability (this relation was counterbalanced between subjects). In the 50% agency-relevant condition, participants learned that both actions produced the objects ‘book’ and ‘glass’ with 50% probability. In the 50% agency-irrelevant condition, participants learned that their actions produced the objects ‘soap’ and ‘chalk’ with 50% probability.

Self-agency task. Next, participants performed the self-agency task. They 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 pressing a left or a right key. Each trial started with a warning signal (i.e., ‘pay attention’ presented for 500 ms.), followed by the alternation of letter strings, and at some point, the stop-cue (an arrow pointing to the left or the right). After each stop, an object word would appear (‘glass’ or ‘book’). Thus, for participants in the agency-relevant conditions, the object words were the same objects that followed their left and right key presses in the probability learning task. For participants in the agency-irrelevant control condition, the objects were new. Participants were told 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 presented object. In actuality, the computer always determined the presented object.

In each trial, 20 letter strings were presented for 150 ms with a 30-ms interval between two successive strings. Participants were told that the two 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. In actuality, as default a row of neutral Xs was presented during this interval. Only on prime trials, the object on which the sequence would stop was primed (in capital letters) for seven times in a row, starting after the presentation of the first five letter strings (i.e., after 870 ms.) and subsequently once every other interval. Thus, the letter strings served as pre- and post-masks for the primes, and the time between primes was 330 ms. The time between the last prime and the STOP-cue was 510 ms.

In line with earlier research that studied outcome priming effects on experienced self-agency (e.g., Aarts et al., 2009; Sato, 2009; van der Weiden et al., 2010), we presented the primes briefly (30 ms.) to prevent participants from becoming aware of the potential role of the outcome primes in changing their experiences of self-agency (see Aarts et al., 2009, for a subliminality check on this procedure). After participants pressed the stop key, the object word was presented and remained on the screen for 500 ms (see also Figure 3.1 for a schematic example of a trial sequence for prime trials). At the end of each trial, participants indicated to what extent they felt that they had stopped the sequence on the presented object (e.g., Aarts et al., 2005; Sato & Yasuda, 2005). This agency feeling was measured on a 10-point scale [*not at all me* (0) - *absolutely me* (9)].

Each of the two object words was presented as an outcome 16 times—8 times after a left key press and 8 times after a right key press (note that the probability that 'book' or 'glass' followed a left or a right key press in this agency-task was 50%). The task thus consisted of 32 trials. Half of these trials were filler-trials to ensure that all combinations of actions and outcomes occurred. The 16 trials of interest (those trials pertaining to the 80% probability action-outcome relations) consisted of 8 prime trials and 8 no-prime trials (see Table 3.1 for an overview of the

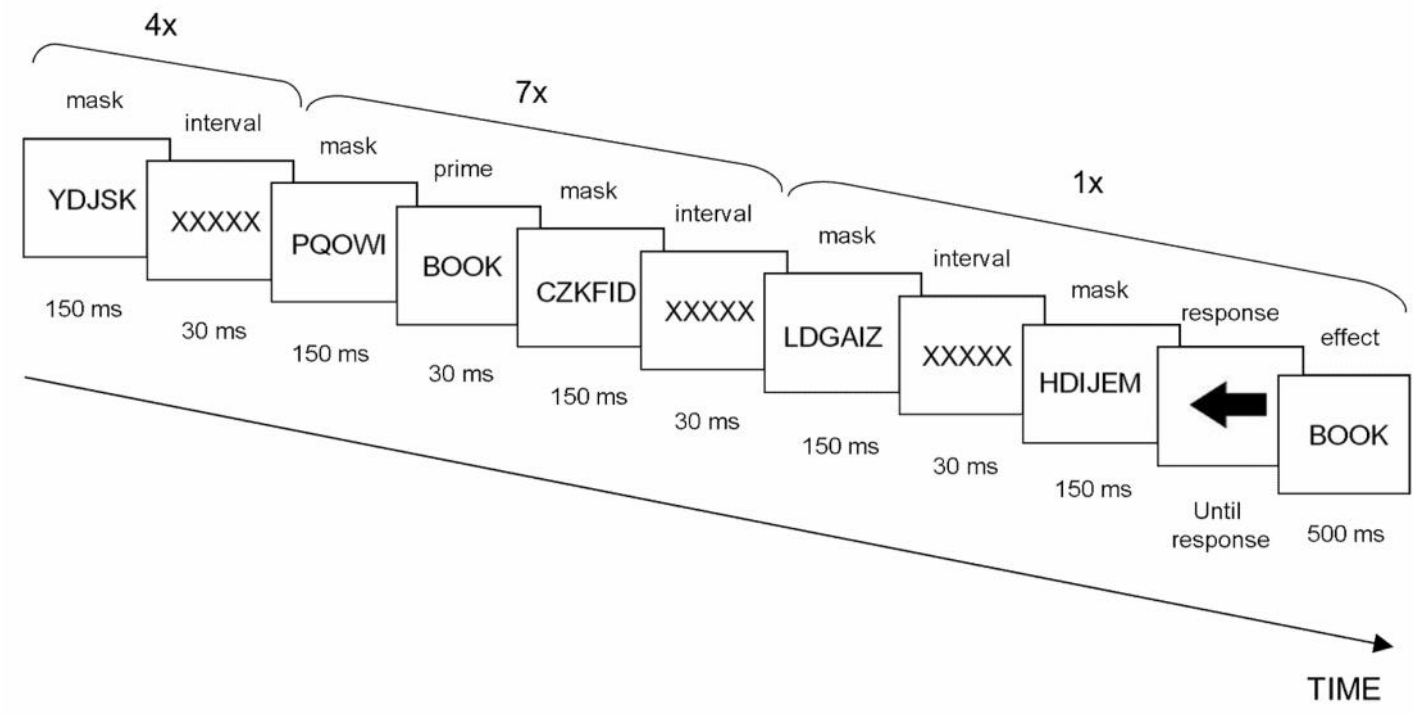

Figure 3.1. Schematic example of a prime trial in the agency-task.

Table 3.1

Overview of number and type of trials in the agency-task, and their relation to the learned action-outcome probabilities for the different conditions. The relations between actions and outcomes were counterbalanced between subjects.

	Probability learning task			Agency-task			
	Action	Outcome	Probability	Action	Outcome	Total trials	Primed trials
80% relevant	Left	Book	80%	Left	Book	8	4
	Right	Glass	80%	Right	Glass	8	4
50% relevant	Left	Book	50%	Left	Book	8	4
	Right	Glass	50%	Right	Glass	8	4
50% irrelevant	Left	Soap	50%	Left	Book	8	4
	Right	Chalk	50%	Right	Glass	8	4

number and type of trials in the agency-task and their relation to the learned action-outcome probabilities for the different knowledge conditions). Trials were presented in random order.

In line with earlier work (Aarts et al., 2009; van der Weiden et al., 2010), debriefing showed that none of the participants reported to have seen the primes. Furthermore, none of them realized the true nature of the study.

Results

Average self-agency ratings were computed for the no-prime trials and the prime trials. These ratings were subjected to an ANOVA, with priming condition (no-prime vs. prime) as a within participant variable and causal knowledge as a between participants variable. This analysis revealed a main effect of causal knowledge ,F (2, 105) = 3.83, p = .03, η_p^2 = .07, such that agency-ratings were higher when learned action-outcome probabilities were 80% ($M_{agency\text{-}related}$ = 4.92, SD = 1.89), rather than 50% ($M_{agency\text{-}related}$ = 3.48, SD = 2.55; $M_{agency\text{-}unrelated}$ = 3.55, SD = 2.55). Comparing the mean of the 80% condition with the combined means of the 50% conditions in a separate contrast analysis also yielded a reliable effect, F (1, 104) = 7.72, p = .006, η_p^2 = .07, indicating that knowledge about the causal relations between actions and outcomes was learned according to the different probability patterns. Furthermore, there was a main effect of priming, F (1, 106) = 5.31, p = .02, η_p^2 = .05. Replicating previous work (e.g., Aarts et al., 2005; Wegner & Wheatley, 1999), self-agency feelings were higher for prime trials (M = 4.02, SD = 2.49) compared to no-prime trials (M = 3.83, SD = 2.47). Importantly, and in line with our hypothesis, the expected interaction between priming and causal knowledge emerged, F (2, 105) = 3.66, p = .03, η_p^2 = .07.

In order to test our specific hypotheses, we performed simple effect analyses. As expected, results showed that outcome priming only enhanced experienced self-agency in the 80% agency-relevant, F (1, 104) = 5.55, p = .02, η_p^2 = .05, and 50% agency-irrelevant conditions, F (1, 104) = 6.47, p = .01, η_p^2 = .06, and not in the 50% agency-relevant condition, F < 1. Figure 3.2 presents the mean experienced self-agency for each cell in the design.

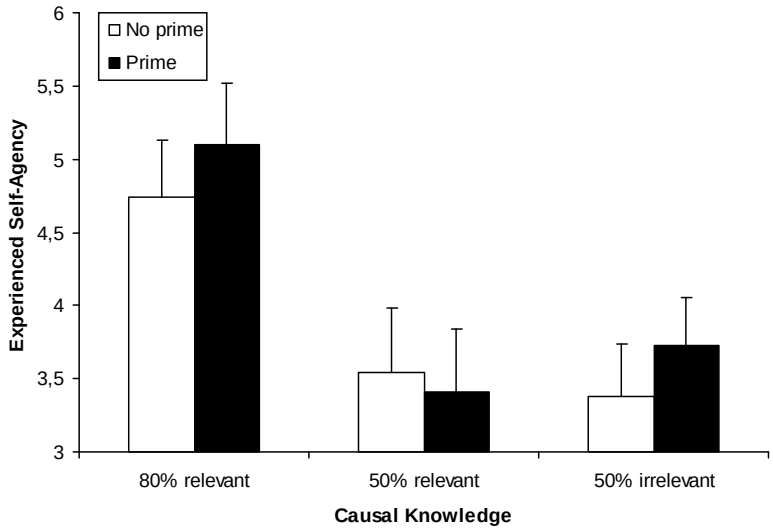

Figure 3.2. Experienced self-agency as a function of outcome priming (no vs. yes) and causal knowledge (80% agency relevant vs. 50% agency relevant vs. 50% agency irrelevant). Error bars represent standard errors of the means.

General Discussion

The present study examined the role of causal knowledge about action-outcome relations in the contribution of motor-predictions and cognitive inferences to experiences of self-agency over action-outcomes.

Results showed that both predictive effects of learned action-outcome probability and inferential effects of outcome priming enhanced experienced self-agency. Furthermore, we established that causal knowledge about the relation between specific actions and outcomes moderated the contribution of both predictions and inferences on experiences of self-agency. When participants learned that actions and outcomes were causally related (with a probability of 80%), motor predictability and outcome priming both enhanced self-agency experiences compared to participants who learned that actions and outcomes were not causally related (with a probability of 50%). Importantly, when participants learned that there was no causal relation between actions and outcomes that were irrelevant to the outcomes over which self-agency was assessed, motor prediction effects stayed off while outcome priming effects re-emerged.

These findings replicate and extend previous work (Sato, 2009) on the role of motor predictions and cognitive inferences in the emergence of self-agency experiences, by showing that outcome priming effects on self-agency crucially depend on whether one has acquired relevant knowledge that informs one that one's actions and outcomes are not causally related. That is, if one has acquired knowledge that one's actions are not causally related to the agency-relevant outcomes, then motor predictions and cognitive inferences do not influence self-agency. However, if one has learned that irrelevant outcomes are not causally related to one's actions, and hence one has learned no relevant knowledge concerning the agency-relevant outcomes, then motor prediction effects do not occur, but inferential priming effects do. These findings suggest that people can experience self-agency over novel action-outcomes of which they have no relevant causal knowledge, irrespective of actual causation, as long as a representation of the outcome was pre-activated in mind.

We further showed that when actions and outcomes were learned to be causally related, predictions and inferences independently affected experiences of self-agency. The independent contribution of motor predictability and cognitive inferential effects of outcome priming has also been addressed in research on the sense of agency in operant action, assessed by the so-called intentional binding effect. Whereas intentional binding was originally suggested to rely only on sensory-motor prediction processes that accompany our intentional actions, recent work suggests that intentional binding is also sensitive to inferential effects of outcome priming. Specifically, when people perform an involuntary induced action in which there are no motor prediction processes involved (e.g., when pressing a key is triggered by an external device) and this action is followed by an outcome (e.g., a tone), intentional binding, and hence, the sense of agency is enhanced by outcome priming (Moore, Wegner, et al., 2009). Given that intentional binding represents an implicit measure of self-agency, and seems to be related with our explicit measure of authorship ascription (Ebert & Wegner, 2010), the present findings suggest that these priming effects in intentional binding of involuntary action are constrained by the causal knowledge that people have about the relation between action and outcome.

The finding that outcome priming effects on experienced self-agency vanish when people learn that their action and the outcome that follows are not causally related, raises questions as to how causal knowledge reduces the impact of inferential processes on experienced self-agency. One possibility is that people no longer represent their action in terms of its outcomes when they learn that the action is not causally related to the given outcome. Recent research showed that outcome priming effects on experienced self-agency are less pronounced when people do not represent their behavior in terms of why (i.e. outcome) they perform an action (van der Weiden et al., 2010, see also Chapter 4 of this dissertation).

Thus, differences in behavior representation may underlie the moderating role of causal knowledge in inferential priming effects on experienced self-agency. Another possibility is that people establish different beliefs as a result of acquired causal knowledge. For instance, people may form the belief that they cannot control a given outcome by performing a certain action when they learned that the action and outcome are not causally related, which discourages them to infer agency over the action-outcome. Consistent with this notion, a recent study (Desantis, Roussel, & Waszak, 2011) indicates that the sense of agency over outcomes that were actually self-caused (as assessed in the intentional binding task) is much weaker when people were led to believe that they did not cause the outcome. Whether differences in behavior representation or causal belief account for the present findings remains an empirical question.

Importantly, however, based on the present findings, we shed new light on the combined contribution of motor predictions and cognitive inferences on self-agency experiences. Specifically, we demonstrated that causal knowledge about actions and outcomes plays a crucial role in both motor-predictive and cognitive inferential effects on experienced self-agency. These two effects operate independently: People experience self-agency over action-outcomes when their motor control system predicts the occurrence of the outcome, and when the outcome corresponds with the outcome they had in mind. However, when one learns that the outcome at hand does not causally follow from one's own action, and this knowledge is relevant for subsequent authorship processing, experiences of self-agency are not affected by motor predictability or inferences based on outcome priming. To conclude, our findings indicate that the experience of self-agency cannot be deceived by the mere priming of outcomes when people know that there is no causal relation between the actions they perform and the outcomes that follow.

CHAPTER 4

Reflecting on the Action or Its Outcome: Behavior Representation Level Modulates High Level Outcome Priming Effects on Self-Agency Experiences

Recent research suggests that one can have the feeling of being the cause of an action's outcome, even in the absence of a prior intention to act. That is, experienced self-agency over behavior increases when outcome representations are primed outside of awareness, prior to executing the action and observing the resulting outcome. Based on the notion that behavior can be represented at different levels, we propose that priming outcome representations is more likely to augment self-agency experiences when the primed representation corresponds with a person's behavior representation level. Three experiments, using different priming and self-agency tasks, both measuring and manipulating the level of behavior representation, confirmed this idea. Priming high level outcome representations enhanced experienced self-agency over behavior more strongly when behavior was represented at a higher level, rather than a lower level. Thus, priming effects on self-agency experiences critically depend on behavior representation level.

Based on: 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.

Human beings have the ability to reflect on their own actions and resulting outcomes, which enables them to distinguish between outcomes that result from the actions of others and outcomes that result from their own actions. As a result, they can attribute these outcomes to the proper agent. The ascription of authorship is fundamental to social communication in particular, and to our society in general. The feeling that one causes one's own actions and their outcomes—also referred to as the experience of personal authorship, or self-agency—serves as an important building block for our concept of free-choice, and as such is central to our social beliefs about whether we can and do have an influence on our own behavior.

An important and intriguing question is how we determine our causal influence in the environment leading to the experience of self-agency over behavior. Usually, the mechanism producing these agency experiences derives from our intentions to engage in behavior (e.g., Bandura, 1986; Deci & Ryan, 1985; Haggard, 2005; Jeannerod, 2003). That is, whether we move our finger, push a switch to turn on a light, or illuminate a room, we experience self-agency when the perception of an event or outcome corresponds with the outcome that we consciously intended to realize. However, recent research suggests that we can have a sense of self-agency even when we do not have a prior intention to produce a specific outcome. Building on the idea that self-agency experiences follow from a match between represented outcomes and the actual observation of these outcomes, this research showed that the authorship ascription process is susceptible to primes. Specifically, information that renders the representation of an outcome active before one performs an action and observes the matching outcome enhances the experience of self-agency, even when this information is presented outside of awareness, through subliminal priming (e.g., Aarts, Custers, & Wegner, 2005; Aarts, 2007b; Sato, 2009). This suggests that people rely on accessible

representations that pertain to the behavior at hand to establish a sense of personal authorship, and that the authorship ascription process can operate outside of conscious awareness.

The present research aims to extend previous work on priming effects on self-agency experiences by exploring the role of representations of behavior in more detail. Specifically, based on the notion that behavior can be represented at different levels (Vallacher & Wegner, 1987) and that these levels of behavior representation play a role in the experience of self-agency (Pacherie, 2008), we propose that outcome priming effects on self-agency depend on the level at which the agent represents her behavior. For example, when a person represents her own behavior of manually operating a light-switch in terms of 'turning on a light' (high level), rather than 'moving the finger' (low level), priming the high level outcome representation (turning on the light) increases the experienced self-agency over the behavior. Until now, the level at which behavior is represented has received only little theoretical and empirical attention in research on the role of priming in the experience of personal agency. Examining priming effects on self-agency experiences as a function of the level of behavior representation, we believe, does not only increase our understanding of when people experience self-agency in the absence of a prior intention to act. It also contributes to the question of why people who suffer from delusions of control may not experience self-agency in the presence of a prior intention to act, as is the case in for example schizophrenic patients (e.g., Frith, 2005; Wegner, 2002).

The notion that behavior can be represented at different levels has been put forward by several models and theories dealing with the cognitive architecture and control of behavior (e.g., Aarts & Dijksterhuis, 2000; Gallistel, 1985; Powers, 1973; Vallacher & Wegner, 1987). According to Action Identification Theory (Vallacher & Wegner, 1987; Wegner &

Vallacher, 1986), any behavior can be identified at multiple levels. Specifically, this theory posits that people who represent their behavior at a low level define their behavior in terms of how an action is done, whereas people who represent their behavior at a higher level define their behavior in terms of why an action is done. This means that what is considered to be the outcome of certain behavior depends on the level at which the behavior is represented. People who represent their behavior at a low level tend to perceive the action in terms of producing sensorimotor consequences or outcomes (i.e., a low level outcome). People who represent their behavior at a high level tend to perceive the action in terms of serving an overarching goal or outcome (i.e., a high level outcome). Research within this framework suggests that levels of behavior representation vary as a function of both context and individual differences and play a role in understanding our own and other people's behavior (Aarts, Gollwitzer, & Hassin, 2004; Kozak, Marsh, & Wegner, 2006; Vallacher & Wegner, 1989; Wegner, Vallacher, Macomber, Wood, & Arps, 1984).

Recently, the idea that behavior can be represented at different levels has also been proposed to play a central role in experiences of self-agency (Belayachi & Van der Linden, 2009; Pacherie, 2008). Of particular relevance is Pacherie's conceptual model of the phenomenology of action, according to which our intentions can operate dynamically at three different levels: At the level of distal intentions (in terms of overarching outcomes of an action), proximal intentions (in terms of situated outcomes of an action), and motor intentions (in terms of the consequences at the sensorimotor level intrinsically derived from the motor control system). Intentions at each level are assigned a specific role in the guidance and control of behavior. A distal intention does normally not cease to exist once it gave rise to a corresponding proximal intention. Similarly, a proximal intention does not disappear once the corresponding motor intention has been issued. Rather, all three levels of intentions coexist,

without the necessity of having an intention at each level in order for behavior to emerge. For example, routine actions can be set in motion by a motor intention and do not always need the guidance and control of proximal or distal intentions (Aarts & Custers, 2009). The model also suggests that the extent to which one experiences self-agency depends on comparisons between the expected and the actual outcomes made at each level of behavior representation. By default, then, intentions pertain to outcome information that guides action control processes at different levels simultaneously. Consequently, self-agency experiences derived from these intentions are more pronounced if the prior intentions and observed outcomes of one's actions correspond at the same levels of behavior representation.

Some suggestive evidence indicating that the experience of self-agency indeed depends on the level at which people represent their behavior comes from studies on action-awareness and monitoring in people suffering from delusions of control, such as patients with schizophrenia and/or affective disorder (Blakemore, Smith, Steel, Johnstone, & Frith, 2000; Franck, Farrer, & Georgieff, 2001; Knoblich, Stottmeister, & Kircher, 2004). For example, in testing their sensory-motor comparator model in the context of the attenuation of self-produced tickle sensations, Blakemore and colleagues (2000) asked their participants to rate the perception of a tactile stimulation on the palm of their left hand. This stimulation was either self-produced or externally produced. Results showed that normal (control) subjects rated the tactile stimulation as less intense when it was self-produced rather than externally produced (see also Blakemore, Wolpert, & Frith, 1998). Interestingly, however, patients suffering from delusions of control (i.e., auditory hallucinations and passivity phenomena) failed to show a difference in perception between the self-produced and externally produced behavioral outcomes.

The failure of patients suffering from delusions of control to notice this difference illustrates that these patients more often attribute self-generated actions to external agents than people who do not suffer from these delusions (e.g., Frith, Blakemore, & Wolpert, 2000b). Such under-attributions of agency might occur because these patients' behavior representations do not correspond with the outcome of their actual behavior, possibly because they lose track of, or do not retain their intentions that caused their behavior (Henry, Rendell, Kliegel, & Altgassen, 2007; Wegner, 2002; Twamley, et al., 2008; Altgassen, Kliegel, & Martin, 2008; Jeong & Cranney, 2009). In other words, these patients do not properly monitor their action with the high level behavior representation in mind, but maintain a representation of what they are doing at a lower level (see also Pacherie, 2008). Consequently, if 'touching the palm of the hand' is represented at a low level (e.g., in terms of moving one's finger), then the touch of the hand palm (i.e., the outcome related to a high level behavior representation) may come as a surprise, thereby leading to the under-attribution of agency over behavior.

The work alluded to above underscores the importance of behavior representations in mapping expected (sensory) outcomes on observed ones as a result of intentional (motor) action. However, recent research indicates that people are quite capable of fluently and perfunctorily ascribing authorship of an observed outcome to oneself. People can experience self-agency over behavior even in the absence of a prior intention to act, as long as a representation of the outcome is active prior to the execution of an action (Aarts, 2007b; Aarts et al., 2005; Sato, 2009; Wegner & Wheatley, 1999). That is, we feel to have produced an outcome when there is a match between the actual outcome and the outcome that we presaged in our mind. Accordingly, experiences of self-agency over behavior are augmented when the representation of the outcome is primed prior to the performance of an action and matches the

actual outcome, even in the absence of a conscious intention to produce the specific outcome.

In a recent study demonstrating this idea, participants and the computer each moved a single gray square in opposite directions on a rectangular path consisting of eight white tiles (Aarts et al., 2005, see also Figure 2.1, Chapter 2, this dissertation). The 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 his or her own square or the computer's square at the time he or she pressed stop. Thus, the participant or computer could have caused the square to stop at the position, rendering the exclusivity of causation ambiguous (cf. Wegner & Wheatley, 1999). Participants either set the intention to stop at a position (a proximal intention, according to the terminology suggested by Pacherie, 2008) or were subliminally primed with that position just before they saw the presented stop at the corresponding location. To measure experiences of self-agency over behavior, participants rated the extent to which they felt to have caused the square to stop. Results showed that both intention and priming increased the sense of self-agency. These findings indicate that on-line self-agency experiences are primarily based on a match between pre-activated and actual outcomes, irrespective of the (conscious or nonconscious) source of this activation. They suggest that people can experience self-agency over behavior even without having the intention to engage in that behavior.

A match between primed and observed behavior representations thus plays a fundamental role in the establishment of personal authorship. Importantly, studies on priming effects on self-agency experiences have so far exclusively focused on the same level of representation of the prime

and outcome. That is, capitalizing on the idea that people are generally inclined to take the overall goal of a task (i.e., high level behavior representation) in mind (Vallacher & Wegner, 1987), participants were assumed to represent their behavior in terms of high level outcomes. Hence, priming high level outcome representations (e.g., the stop location of a moving square) augmented their sense of self-agency over behavior (e.g., stopping the square at the presented location). However, because the level of behavior representation can vary across people and situations, it remains to be seen whether and how the level of behavior representation modulates priming effects on self-agency experiences. The present research explores this issue in more detail.

Specifically, we conducted three experiments in order to investigate the role of behavior representation level in priming effects on the experience of self-agency over behavior (such as stopping a rotating square on a specific location on the computer screen) while self-causation is ambiguous (Aarts et al., 2005). We propose that priming high level outcome representations (e.g., the position of the stopped square) enhances experiences of self-agency when people represent their behavior at a high level (e.g., stopping the square at a specific location) rather than a lower level (e.g., pushing a button). Following earlier work on priming effects on self-agency experiences (e.g., Aarts, 2007b; Aarts et al., 2005; Sato, 2009), we expected these moderating effects of behavior representation level to occur even though the high level outcome representation is primed outside of participants' conscious awareness. In other words, we expected that behavior representation level plays a role in experiences of self-agency over behavior, even in the absence of a prior conscious intention to produce the specific outcomes.

In a first experiment, we used a modified version of a task recently employed in research studying subliminal priming effects on on-

line experiences of self-agency in a context where performance of behavior is ambiguous (Aarts, Custers, & Marien, 2009). In this task, participants have to stop a rapidly presented sequence of consumer products and then observe that the sequence stops on one of the products. This task could be represented as pressing a stop-key (lower level behavior representation) or as stopping on a product (higher level behavior representation). Participants were subliminally primed with the products (high level outcome) or not before they observed the stopped product and indicated their sense of self-agency over stopping on the product. The moderating role of behavior representation level was investigated by measuring individual differences in the extent to which participants represented their behavior in terms of producing the high level outcomes in the task at hand. In the second experiment, using the stopping of the rotating square paradigm (Aarts et al., 2005), participants were again primed with high level outcome information, but this time we measured participants' general dispositions toward behavior representation levels with the validated Behavioral Identification Form (BIF; Vallacher & Wegner, 1989). Finally, in the third experiment, we manipulated participants' task-related behavior representation level.

Experiment 4.1

In the first experiment, participants learned to stop a sequence of eight (consumer) products rapidly presented on the computer screen by a key-press that was immediately followed by the presentation of one of the eight products. Next, they learned that during the remaining part of the experiment, the products in the sequence would be removed and replaced by eight briefly flashed letter strings, and that pressing the stop-key during the alternation of these strings would be followed by one of the previous eight products. In addition, it was told that the presented product might also be determined by the computer. It was explained that this adaptation

of the task was used to examine experiences of behavior when the performance of behavior is ambiguous (cf. a gamble machine, in which one stops rapidly rolling symbols by pushing a button). In reality, the computer always determined the product. 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 stopped the presented product.

The replacement of the products by letter strings served three important experimental purposes: (1) The presentation of the letter strings prevented participants from identifying which product was on the screen at the moment they pressed the key to stop the sequence of products, and hence from using it as a predictor for which product would appear; (2) Removing the products and presenting the letter strings ensured that the products would not serve as primes by themselves during the sequence interval; (3) The sequence of strings allowed us to prime specific outcome information (i.e., the product names) in the absence of participants' awareness before they stopped the sequence. Thus, although our task allowed participants to have agency over pressing the stop-key, they could not predict the exact outcome of that action, hereby rendering the experience of self-agency over stopping the product sensitive to the priming manipulation. At the end of the experiment, participants indicated the extent to which they represented the task in terms of how the action was done (that is, pressing the stop-key; a low level behavior representation) or in terms of why the action was done (that is, to stop a specific product; a high level behavior representation). This measure enabled us to test priming effects on self-agency as a function of the level of representation of the task-related behavior.

Based on the line of reasoning addressed before, we expected that priming high level outcome (product) representations of behavior is more

likely to augment the experience of self-agency over stopping the products when participants represent their behavior in terms of producing these higher level outcomes rather than producing lower level outcomes (e.g., in terms of pressing a stop-key).

Method

Participants and design. Forty-four undergraduates participated in this experiment in return for course credit or a small fee. All participants were presented with two types of trials: trials on which the high level outcome representation (the product that would be presented after the key-press) was primed and control trials without such primes. Hence, priming constituted a within-participant factor. Additionally, participants' task-related behavior representation level was measured and used as a between-participants factor.

Experimental task and procedure. Participants worked on the task individually. They were told that the study was designed to examine people's experiences of behavior and how these experiences come and go. For this purpose, they would operate a kind of vending machine that was programmed on a computer. Specifically, they learned to stop a sequence of eight (consumer) product words rapidly presented in the middle of the computer screen by pressing a designated key on the keyboard upon seeing the message ***STOP***. The products were neutral to our sample of participants (e.g., spoon, ball-point). Participants were told that upon pressing the stop-key, the rapid alternation of the product words would stop and that the product on which they had stopped the sequence would appear at the bottom of the screen (in the virtual drawer of the vending machine). Each trial began with a start-cue, proceeded with the alternation of the product words, and at some point, the stop-cue. The product words were presented for 170 ms each, with a 30-ms blank screen in between.

The stopped product was presented 100 ms after participants pressed the stop-key and remained on the screen for 600 ms.

After some practice, participants were told that the task would change a bit to examine experiences of behavior when the performance of behavior is ambiguous. Specifically, they learned that the eight products would no longer be presented on the screen, but instead would be replaced and symbolized by the alternation of eight different strings of capital letters (e.g., PAEXJDF). Hence, they were told that now stopping the sequence of briefly flashed letter strings would be followed by the presentation of a product. In addition, they were told that the product presented after they pressed the stop-key could also be determined by the computer (in fact, the computer always determined the presented product). Participants thus were led to believe that either they themselves or the computer could be the cause of the presented product. It was further told that the time of a trial could vary, and therefore it was stressed that participants should keep focused on the strings to not miss the STOP-cue. In actuality, the sequence of briefly flashed letter strings lasted 5600 ms. After each presented product, participants indicated to what extent they felt that they had stopped the product. This agency feeling was measured on a 10-point scale [*not at all me* (0) - *absolutely me* (9)]. Each of the eight products was presented as an outcome four times—twice in the prime condition and twice in the no-prime condition. The experimental task thus consisted of 32 trials. Trials were presented in random order. Participants first practiced the task to figure out when and how to press the stop-key and then moved on to the experimental task.

Product priming. The name of the product (in capital letters) was either subliminally primed or not within the presentation stream of letter strings (for a subliminality check of this procedure, see Aarts et al., 2009). Each letter string was presented for 170 ms, and between two successive

strings there was a 30-ms interval. As a default, a row of neutral Xs was presented during this interval. On the prime trials, a product name was presented in every 30-ms interval for seven times in a row. Thus, the letter strings served as pre- and post-masks for the primes, and the time between primes was 170 ms. The time between the last prime and the STOP-cue was 200 ms.

Measuring the level of behavior representation. At the end of the task, participants responded to two 9-point scale items that measured the level of behavior representation (cf. Vallacher, Wegner, McMahan, Cotter, & Larsen, 1992). One item probed participants to identify their behavior either in terms of pressing the stop-key or in terms of stopping a specific product. The other item asked them to indicate the extent to which they had tried to determine on which product the sequence would stop. The two ratings were averaged into an index of level of behavior representation (α = .54), with lower scores reflecting a lower representation level, and higher scores reflecting a higher representation level.

Debriefing. As in earlier work on subliminal priming effects on self-agency experiences using the sequence task (Aarts et al., 2009), debriefing showed that none of the participants were aware of the presentation of the primes (product words). Furthermore, none of them realized the true nature of this study. Two (nonnative speaking) participants indicated to have misunderstood the task instructions. These two participants were omitted from the analyses.

Results

Average ratings of agency were computed for the no-prime trials and the prime trials. These ratings were subjected to a General Linear Model, with priming condition (no-prime vs. prime) as a within-subject variable and behavior representation level as a (between-subjects)

continuous variable. This analysis revealed a significant interaction between prime and behavior representation level, F (1,40) = 5.87, p = .02 , η_p^2 = .13.

In order to examine this interaction and to test our specific hypothesis, the effect of priming on self-agency experiences was assessed for participants with a low level behavior representation (one standard deviation below the mean) and for participants with a high level behavior representation (one standard deviation above the mean) separately (see Aiken & West, 1991). These analyses showed that participants with a high level behavior representation experienced stronger self-agency over stopping the product when product words were primed, compared to when product words were not primed, F (1,40) = 6.78, p = .01, η_p^2 = .15). Product word priming did not influence experienced self-agency for participants who represented their behavior at a lower level, F < 1. Figure 4.1 presents the mean experienced self-agency for each cell in the design.[1]

Discussion

The findings of Experiment 4.1 confirmed our predictions: For participants who represented their behavior as "stopping on a product", subliminally priming the name of a product before participants stopped the sequence and perceived the corresponding product enhanced their experienced self-agency, whereas no such priming effect occurred for participants who did not represent their behavior as "stopping on a product". Thus, when the subliminal primes corresponded with participants' behavior representation, participants' self-agency experiences over behavior increased compared to when no subliminal primes appeared.

[1.] Across the three studies, there were no consistent and reliable effects of priming on participants' speed of pressing the key in response to the stop signal. Thus, primes did not affect participants' stopping behavior.

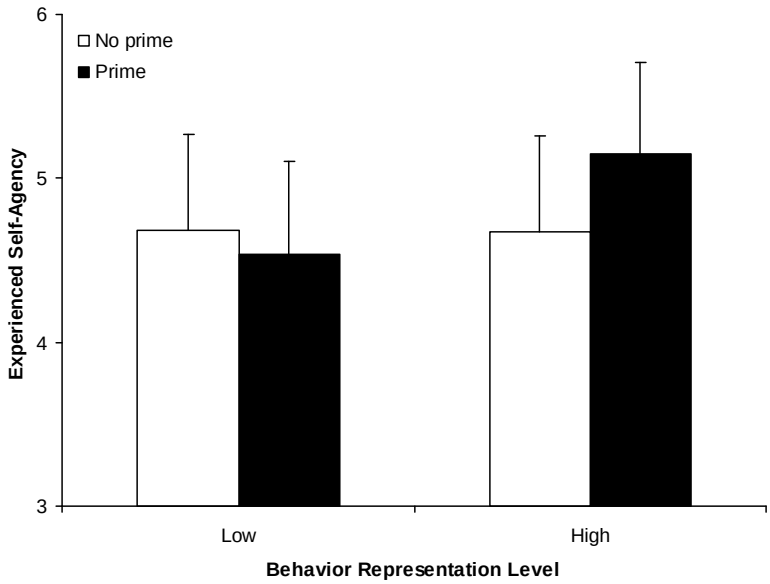

Figure 4.1. Experienced self-agency as a function of priming (no-prime vs. prime) for participants with a low behavior representation level (one standard deviation below the mean) and for participants with a high behavior representation level (one standard deviation above the mean). Error bars represent standard errors of the means.

However, when participants' behavior representation did *not* correspond with the subliminal primes, no priming effect on experienced self-agency occurred. Given that the behavior of "stopping on a product" reflects a high level representation within the present task context, it seems likely that participants who did not represent their behavior at this high level, represented their behavior at a lower level, for example in terms of "pressing a stop-key". Accordingly, these findings support our hypothesis that the level of behavior representation moderates subliminal priming effects on self-agency experiences.

In the light of the robustness of previous subliminal priming effects on experienced self-agency (e.g., Aarts et al., 2005, 2009; Sato, 2009), it is noteworthy that self-agency experiences of participants who did not represent their behavior as "stopping on a product" were unaffected by subliminally priming the name of the product that was about to be selected from the vending machine. As such, the absence of a priming effect in the present experiment suggests that the level of behavior representation is a crucial determinant in the experience of self-agency over behavior. To further substantiate this claim, in Experiment 4.2 we assessed participants' behavior representation level in another way, by measuring participant's dispositional behavior representation level with the Behavioral Identification Form (BIF; Vallacher & Wegner, 1989). The BIF is designed to assess individual differences in the level at which people generally represent their behavior (i.e., in terms of how an action is done – low level – or in terms of why the action is done – high level) across an array of actions. The measure has been shown to meet convergent, divergent and predictive validity criteria. Important for the present purpose, we expected this general disposition of behavior representation level to modulate priming effects on self-agency experiences over producing high level outcomes.

Experiment 4.2

In the second experiment, we used a different paradigm for assessing self-agency experiences to extend our findings to another task setting. Specifically, participants performed an adapted version of the stopping of the rotating square paradigm (see Aarts et al., 2005). In this task, participants and the computer each moved a single gray square in opposite directions on a rectangular path consisting of eight white tiles. Pressing a stop-key turned one of the eight tiles black, representing the location of either the participants' square or the computer's square.

Importantly, the participant or computer could have caused the square to stop at the position, rendering the exclusivity of causes of outcomes ambiguous (cf. Wegner & Wheatley, 1999). To measure experiences of self-agency, participants rated the extent to which they felt to have caused the square to stop.

In this task, participants were either subliminally primed or not with a location before they stopped the moving square and were subsequently presented with the squares' stop location. Also, each participant's dispositional behavior representation level was measured with the Behavioral Identification Form (BIF; Vallacher & Wegner, 1989). We reasoned that a high representation level in the task corresponds with the behavior of stopping the traversing square on a location, because this represents the goal of the action (why the action is done), whereas a low representation level in this task corresponds with the action's execution of pressing the stop-key (how the action is done). Based on previous findings (Aarts et al., 2005) and the results of Experiment 4.1, we expected that priming the stop location augments experiences of self-agency for participants with a tendency to represent their behavior at a high level, thus in terms of stopping the square on a location in the task at hand.

Method

Participants and design. Sixty undergraduates participated, receiving course credits or a small fee in return. All participants were primed with high level outcome information (the stop location of a moving square) or not, and this factor thus constituted a within-participant variable. Additionally, participants' general disposition toward behavioral representation level was measured with the BIF (Vallacher & Wegner, 1989) and served as a between-participants factor.

Experimental task and procedure. Participants worked individually on the task. They learned that the study was designed to examine people's experiences of behavior and how these experiences come and go. For this purpose, participants would move a gray square rapidly traversing a rectangular path in a counter-clockwise direction by pressing and holding the S-key. This path consisted of eight white tiles. The computer independently moved another gray square along the path at the same speed, but in the opposite direction (clockwise). At a certain point in time, participants had to stop the movement immediately by pressing the Enter-key (see also Aarts et al., 2005). This action turned one of the eight white tiles black, representing the location of either their square or the computer's at the time they pressed stop. Thus, the black square could be represented as the consequence of their action. Note, however, that the stop location was always determined by the computer and hence, actual control was absent. Cues for responding were displayed in the middle of the rectangular path. It was stressed that participants should keep focused on the screen during the task. After each stop, participants indicated how much they felt they had stopped the square at the presented position. This agency feeling was measured on a 10-point answer scale [*not at all me* (0) - *absolutely me* (9)]. The stopped location was presented twice on each of the 8 tiles of the path. The experimental task thus consisted of 16 trials. Trials were presented in random order.

Events in a trial. Each trial started with a warning signal. Next, the message "start" was presented until participants pressed the S-key. One second after they pressed (and held) the S-key, their and the computer's square started to move along the path in alternating motion (that is, the squares were displayed one after the other). Squares were displayed for 60 ms on each position. Thus, the speed of one lap was 960 ms [60 ms x 8 positions x 2 (participant's and computer's square)]. The number of laps in a trial that was completed before the message "stop" appeared could vary

between 8 and 10, and was randomly determined by the computer. From the moment that the message “stop” appeared, only the eight empty white tiles were visible until the participant pressed “Enter”. On that response, a black square was presented after 100 ms, for 1 s. The placement of this square was always 4 positions farther than the last position of the participant’s square before the message “stop” had appeared. So, for example, the black square was presented in the right lower corner position after the participant’s last square was presented in the left upper corner position; the black square was presented in the right middle position after the participant’s last square was presented in the left middle position, etc. Thus, participants did not have actual control, as the position of the black square did not depend on their action.

Outcome priming. On eight trials, a black square was flashed on the position on which the square would stop, just before the message “stop” appeared on the screen. Thus, the primed location corresponded with the presented location of the black square. The location-prime (e.g., lower corner right) occurred 40 ms after the last presentation of the participant’s square (e.g., upper corner left). Location-primes were presented for 34 ms, and were 46 ms later followed by the message “stop” (the total time for the priming event thus was 120 ms). In the no-high level outcome priming condition, the position of the black square was not flashed (the position appeared in white for 34 ms). The priming event was employed for every possible location, resulting in 8 replications of the high level outcome priming condition and the no-high level outcome priming condition.

Measurement of behavior representation level (BIF). A few days before the experimental task, participants filled out a questionnaire as part of another unrelated study. This questionnaire included the Behavioral Identification Form (BIF; Vallacher & Wegner, 1989). The scale consists

of 25 items (forced choice options), and each item of the BIF consists of an action followed by two alternatives or 'identities', one of which is lower and one of which is higher in level. For example, "the act of reading", followed by "(a) following lines of print" (lower level behavior representation) and "(b) gaining knowledge" (higher level behavior representation). For each action, participants had to choose the alternative that best describes the action they would carry out. All items were combined into an overall BIF-score. A higher score reflects a higher level of behavior representation.

Debriefing. As in earlier work (Aarts et al., 2005), debriefing showed that none of the participants had seen the position-primes. Furthermore, none of the participants realized the true nature of the study.

Results and discussion

The average ratings of experienced self-agency across the eight no-high level outcome priming trials and eight high level outcome priming trials were subjected to a General Linear Model with priming condition (no-prime vs. prime) as a within-subject variable and the BIF-score as a (between-subjects) continuous variable. This analysis yielded a significant interaction effect of priming and BIF, F (1,58) = 3.98, p = .05, η_p^2 = .06.

In order to examine this interaction in more detail and to test our specific hypothesis, we assessed the effect of priming on self-agency experiences for participants with a low BIF-score (one standard deviation below the mean) and for participants with a high BIF-score (one standard deviation above the mean) separately (see Aiken & West, 1991). These analyses revealed a substantial priming effect within the group of participants with a high BIF-score (i.e., high general tendency to represent their behavior in terms of why an action is done). Priming strongly augmented these participants' experiences of self-agency, F (1,58) = 19.80,

$p < .001$, $\eta_p^2 = .25$. Priming enhanced the experienced self-agency in participants with a low BIF-score (i.e., general tendency to represent their behavior in terms of how an action is done), but this effect did not reach the conventional level of significance, $F(1,58) = 2.62$, $p = .11$, $\eta_p^2 = .04$. Figure 4.2 displays the mean agency feelings as function of priming and BIF-score.

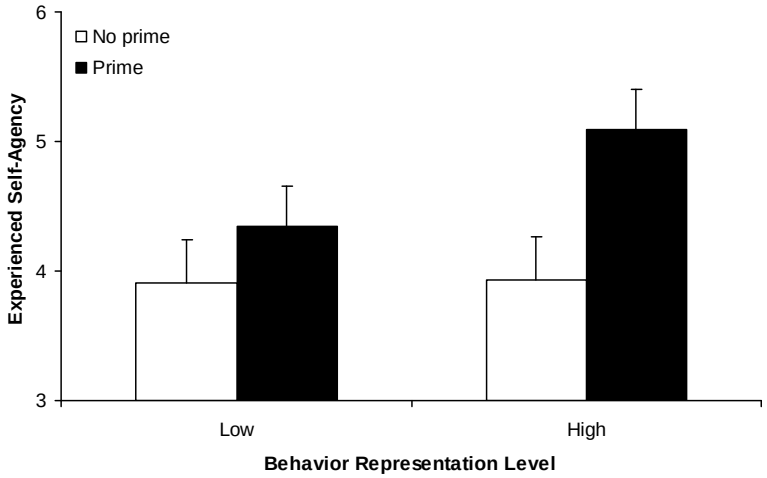

Figure 4.2. Experienced self-agency as a function of priming (no-prime vs. prime) for participants with a low behavior representation level (one standard deviation below the mean) and for participants with a high behavior representation level (one standard deviation above the mean), as measured by the Behavioral Identification Form (BIF; Vallacher & Wegner, 1989). Error bars represent standard errors of the means.

Consistent with findings of Experiment 4.1, we found that participants with a dispositional tendency to represent their behavior on a high level experienced increased self-agency as a function of priming the stop location. Participants with a dispositional tendency to represent their behavior on a low level did not show increased self-agency experiences as

a function of priming the stop location. Thus, subliminally priming a high level outcome representation (i.e., the square's stop location) more strongly affected experienced self-agency of participants with high level behavior representations than of participants with low level behavior representations.

The results of the first two experiments show that the level of behavior representation is associated with participants' susceptibility to subliminal priming effects of high level behavior outcomes on experienced self-agency over behavior. Participants with a high level behavior representation were more strongly affected by high level outcome primes than participants holding a low level behavior representation. In our final experiment, we wanted to take the evidence for our hypothesis one step further by determining the causal influence of behavior representation level on experienced self-agency as function of high level outcome priming. Therefore, we manipulated the level of behavior representation.

Experiment 4.3

The instructions and procedure in Experiment 4.3 were the same as in Experiment 4.2. However, here, we manipulated, instead of measured, participants' behavior representation level. In the low level representation condition, participants were induced to represent their behavior in terms of producing a low level behavior outcome (moving the right finger to push the stop-key). In the high level representation condition, participants were induced to represent their behavior in terms of producing a high level behavior outcome (pushing the stop-key to stop the square on a position). Based on the findings of Experiments 4.1 and 4.2, we expected priming of the stopped position to enhance self-agency experiences, but mainly in the condition where participants represented their behavior in terms of the higher level outcome.

Method

Participants and design. Seventy-four undergraduates completed this experiment in return for course credit or a small payment. All participants were primed with high level outcome information (the stop location of a rotating square) or not, and this factor thus constituted a within-participant variable. Furthermore, half of the participants were induced with a low level representation, and half of them with a high level representation. Thus, behavior representation level was a between-participants variable. Participants were randomly assigned to the representation level conditions.

Experimental task and procedure. The task and procedure were similar to those of Experiment 4.2, with one major modification. In this experiment, half of the participants were induced to represent their behavior at a low level (in terms of how the action is done), whereas the other half were encouraged to represent their behavior at a high level (in terms of why the action is done). For this purpose, participants learned that they would receive a brief message on the computer screen before the start of each trial telling them what to do when the message "STOP" appeared on the screen. Specifically, in the low level representation condition, the message cued them to move the right finger to press the key. Thus, the participants in this condition represented the task in terms of action execution upon the message stop. In the high level representation condition the message probed them to determine the stopped position of the square when pressing the key. Accordingly, participants in this condition represented the task in terms of the higher level outcome of their action upon the stop message.

In both conditions, the instruction appeared for 3 seconds at the beginning of a trial. Then, the trial proceeded as described in Experiment

2. That is, participants pressed (and held) the S-key upon the message "start", their and the computer's square started to move along the path in alternating motion, the stop-cue appeared, and participants pressed the designated stop-key. Also similar to Experiment 4.2, after each stop, participants indicated how much they felt they had stopped the square at the presented position (measured on a 10-point answer scale). Each of the 8 tiles of the path was selected twice as the stop location. The experimental task thus consisted of 16 trials and trials were presented in random order.

Debriefing. As in our previous experiments, debriefing showed that none of the participants had seen the position-primes, even though they all indicated to have focused on the screen during the task. Furthermore, none of the participants realized the true nature of the study.

Results and discussion

Average experienced self-agency was computed for the no-prime trials and the prime trials, and subjected to a 2 (priming: no-prime vs. prime) within-participant x 2 (behavior representation level: low vs. high) between-participants ANOVA. This analysis revealed the expected significant interaction effect of priming and behavior representation level, F (1, 72) = 4.85, p = .03, η_p^2 = .06.

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 high level representation condition, the prime led to higher agency ratings than the no-prime condition, F (1, 72) = 22.84, p < .001, η_p^2 = .24. However, this priming effect was much weaker and only marginally significant in the low-level representation condition, F (1, 72) = 3.75, p = .06, η_p^2 = .05. The mean self-agency scores across conditions are presented in Figure 4.3.

Replicating the results of Experiment 4.1 and 4.2, the results of Experiment 4.3 showed that subliminally priming high level outcome representations before the execution of an action enhances experiences of self-agency when behavior is represented at a high, compared to a low level. Additionally, these results indicate that the experience of self-agency is affected not only by general dispositions toward behavior representation levels, but is also susceptible to contextual cues that induce different levels of behavior representation.

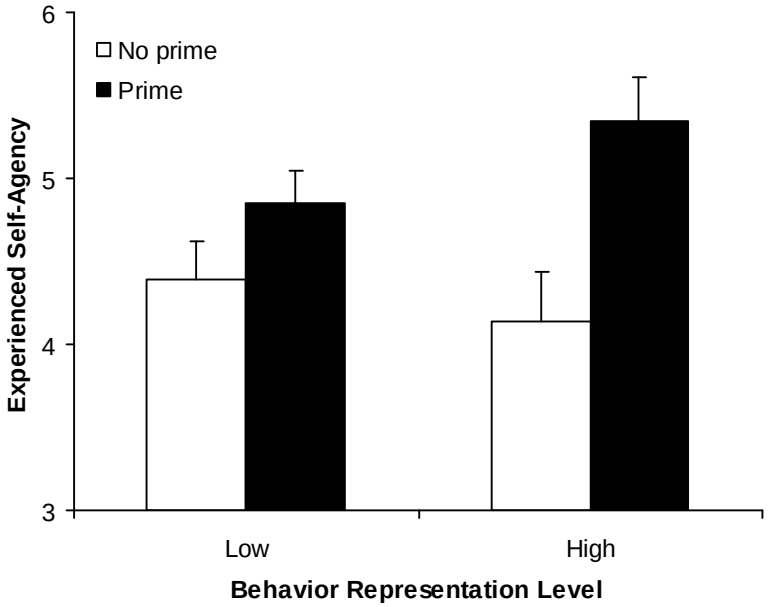

Figure 4.3. Experienced self-agency as a function of priming (no-prime vs. prime) and manipulated level of behavior representation (low vs. high). Error bars represent standard errors of the means.

General Discussion

The present study examined whether the level at which a behavior is represented affects the experience of self-agency over the behavior. Together, three experiments showed the crucial role of behavior representation level in priming effects on the experience of self-agency as a function of both context and individual differences. Specifically, in the first experiment, we manipulated participants' experience of self-agency by priming high level outcome information in a task where self-causation was ambiguous, and we measured individual differences in the extent to which behavior was represented in terms of a goal outcome accomplished by the action in the task at hand. In the second experiment, we measured participants' general tendencies to represent their behavior at a high or a low level. Finally, in the third experiment we *manipulated* participants' behavior representation level. Results showed that priming high level outcome representations enhanced experiences of self-agency when participants represented their behavior at a high level (i.e., in terms of why the action is done; e.g., stopping the square on a specific location) rather than a lower level (i.e., in terms of how the action is done; e.g., pushing a button). Thus, a match between primed outcomes and actual behavioral outcomes is not sufficient to affect experiences of self-agency. Primed outcomes should also correspond with the level at which the observer represents his or her behavior in terms of the outcomes.

Consistent with previous research examining priming effects on self-agency experiences, we showed that experiences of self-agency can emerge even in the absence of a conscious intention to act. That is, experiences of self-agency emerge when nonconsciously activated outcome representations match the observed behavior. This enables people to experience a sense of self-agency not only over behavior resulting from conscious intention (e.g., Haggard, 2005), but also over behavior that, in

fact, is influenced by cues in our environment outside our conscious awareness (Aarts et al., 2009; Wegner, 2002). Whereas the finding that nonconscious activation of behavior representations increases experiences of self-agency is intriguing and important, the exact mechanism underlying these priming effects requires further examination. Based on the idea that overt behavior and resulting experiences of self-agency originate from the activation of relevant behavior representations the mechanism may unfold in two different ways. One possibility is that priming and conscious intentions enhance self-agency in a similar way by the mere activation of the same behavior representation, thereby rendering the conscious intentional source of self-agency more or less a by-product (Aarts et al., 2005). Another possibility is that priming of behavior representations causes people to consciously form intentions to produce the primed behavior, and thus self-agency results from intentional processes. Whereas both mechanisms may account for our daily experiences of self-agency, it would be interesting to sort out when one of these two different mechanisms is more likely to operate.

The present research discerns previous findings showing priming effects on self-agency experiences by demonstrating that people do not always experience enhanced self-agency when accessible outcome representations match the actual behavior outcome. Importantly, accessible behavior representations should also correspond with the level at which behavior is represented (cf. Pacherie, 2008). This implies that people's sense of self-agency is not influenced by the sheer priming of information that renders the representation of an outcome active when they do not represent their behavior in terms of producing that outcome.

Interestingly, our research on the effects of outcome priming on self-agency experiences as a function of the level of behavior representation does not only increase our understanding of when people

experience self-agency in the absence of a prior intention to act. It also contributes to the question of why people sometimes do not experience self-agency over a behavioral outcome in the presence of a prior intention to obtain that outcome. Indeed, recent research shows that there can be situations in which people do not experience self-agency despite the presence of an intention to act (e.g., Frith, 2005; Wegner, 2002). Even though one has an intention to produce a particular outcome, one may lose track of this intention along the way. This can occur if one does not maintain a high level behavior representation in mind while monitoring the action at a lower level (see also Pacherie, 2008), for example when a task is relatively difficult. In that case, people will re-identify their behavior at a lower level to remind themselves of how the action is done (Vallacher & Wegner, 1987). As a consequence, they may no longer experience self-agency over the high level outcomes of their own behavior.

In addition to the fact that context (such as task difficulty) can influence the level at which behavior is represented, there also seem to be individual differences in behavior representation level that can affect our experiences of self-agency. Here, we used the BIF measure to assess such individual differences. This measure has been shown to correlate with self-understanding and action effectiveness (Vallacher & Wegner, 1989). That is, the more people are generally inclined to represent their behavior at a high level, the more they think of their behavior as indicative of their personality, being planned instead of impulsive, and the more effective they are in the execution of actions. This suggests that people who represent their behavior at a high level may be more successful in monitoring their goals, keeping a representation of their goals active. As a consequence, they may more often experience a sense of self-agency over their intentional behavior when attaining their goals than people who represent their behavior at a lower level. As the present findings suggest, however, people who generally represent their behavior at a high level may

also be more prone to experience enhanced self-agency when the high level outcome (the goal that their action may serve) is primed outside of awareness just before action execution and outcome observation. Consequently, representing behavior at a higher level may more easily lead to illusory perceptions of self-causation and control.

The observation that behavior representation levels play a crucial role in the establishment of self-agency experiences may have important implications for our understanding and examination of the role of action-outcome contingency in the perception of control and self-causation. First, a growing literature shows that people's sense of control (a crucial contributor to one's sense of agency over actions; Pacherie, 2008) increases as a function of contingency between actions and outcomes (Alloy & Abramson, 1979; Gollwitzer & Kinney, 1989; Jenkins & Ward, 1965; Shanks & Dickinson, 1991). That is, the higher the probability that outcome *B* results from action *A* (i.e., high action-outcome contingency), the more we will feel to have caused outcome *B* after executing action *A*. Also, when an action is consistently followed by a high level outcome, people are more inclined to plan and represent their behavior in terms of that outcome (e.g., Aarts & Custers, 2009; Nattkemper & Ziessler, 2004; Prinz, 1997; Vallacher & Wegner, 1987). Thus, behavior representation levels could play a role in contingency effects on self-agency, because people may be more likely to represent behavior in terms of its higher level outcome when the behavior produces the outcome with higher probability. In other words, differences in contingency between actions and high level outcomes induce different levels of behavior representation.

Other research examining contingency effects on self-agency experiences proposes that the representation of behavior in terms of outcomes leads to the perception that action and outcome occur closer together in time (Engbert & Wohlschläger, 2007; Haggard, Clark, &

Kalogeras, 2002). This temporal binding effect as a result of intentional action is associated with increased experiences of self-agency (Engbert, Wohlschläger, & Haggard, 2008) and has been shown to increase as a function of higher action-outcome contingencies (Moore & Haggard, 2008; Moore, Lagnado, Deal, & Haggard, 2009). This finding offers suggestive evidence that action-outcome contingency influences both the level of behavior representation and the extent of experienced self-agency. Building on the assumption that people represent their behavior in terms of high level outcomes when these outcomes follow their actions with higher probability, priming high level outcome representations should augment experiences of self-agency in a context where contingency between actions and high level outcomes is high.

Indeed, research examining the role of outcome predictability in priming effects on self-agency experiences supports this hypothesis (Sato, 2009; Experiment 3). In this experiment, participants had to press a left or right key in the service of producing two different (high level) outcomes (a blue or red circle presented on the computer screen). The outcomes could also be produced by the computer, rendering the cause of the outcomes ambiguous. To examine priming effects on self-agency experiences, the high level outcomes (the colors) were, or were not, subliminally primed. The role of high level outcome predictability was also investigated. Each of the two responses was followed by one particular color in 50% (low predictability) or 75% (high predictability) of trials. Results showed a substantial effect of high level outcome priming on experienced self-agency when predictability was high (75%) and no priming effect when predictability was low (50%). Assuming that people are more likely to represent their behavior in terms of high level outcomes when predictability is high rather than low, these findings support our hypothesis that the level of behavior representation moderates high level outcome priming effects on self-agency experiences. Importantly, whereas both

statistical contingencies and levels of behavior representation can underlie the experience of self-agency, future research could examine when the predictive or the representational aspect of behavior contributes to the establishment of self-agency, and whether their contribution may differ as a function of conscious (intentional) and nonconscious priming of outcome information.

It is important to note that the present experiments used paradigms designed to prime high level outcomes and to measure self-agency experiences over high level behavior outcomes. We therefore provided a partial test of the moderating role of the level of behavior representation in priming effects on self-agency. Yet, we do not know whether priming low level outcome information also enhances self-agency experiences, in particular when behavior is represented at a low level and the cause of one's own action is unclear. For example, when representing behavior in terms of how an action is done rather than why the action is performed, priming representations with respect to sensorimotor feedback before actual movement may increase experienced self-agency over action execution. This enhanced self-agency over action execution perhaps in turn also enhances self-agency experiences over producing high level behavior outcomes. Future research needs to address this issue.

To conclude, the present results replicate and extend recent research on the emergence of self-agency experiences in the absence of a prior intention to act (Aarts, 2007b; Aarts et al., 2005; Sato, 2009; Wegner & Wheatley, 1999). Building on earlier work, we presented novel evidence for the crucial role of behavior representation levels in subliminal priming effects of high level outcome representations on the experience of self-agency as a function of both context and individual differences. In doing so, we hope that the present research may offer new directions in the study of self-agency to further our understanding of why we believe that we can

and do have an influence on our own behavior and, as such, feel responsibility for what we do.

CHAPTER 5

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

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 two 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 two distinct inferential routes, and that goals and primes differentially affect the perception of our own behavior.

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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. Or 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. Thus, whether engaging in simple motor movements or social interactions, 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., the priority principle), resulting in the experience of

self-agency to the extent that an outcome matches this preview (i.e., the 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 occur without much conscious intent and thought. Specifically, observing outcomes that are implicitly pre-activated 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; Wegner & Wheatley, 1999; van der Weiden, Aarts, & Ruys, 2010). This research suggests that experiences of self-agency result from cognitive inferences that are based on representations of outcomes that serve as mental previews, irrespective of whether these representations are pre-activated 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, et al., 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 (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, that are perceived 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 5.1 in the Method section of Experiment 5.1 for a visualization of the task). 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, which 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 had 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 pre-activation of outcome) condition that was administered in a first block of trials. The

priming effects are robust and have been replicated across different tasks (Aarts, 2007a; Ruys & Aarts, 2012; van der Weiden et al. 2010, Chapter 4; Wegner & Wheatley, 1999), and in different cultures (Aarts, Oikawa, & Oikawa, 2010). Importantly, these findings suggest that people experience self-agency when the outcome of their action matches the outcome that they have in mind, irrespective of the source of the pre-activated 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 unique effects on the processes that render goal achievement 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 probably 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 suggests (e.g., Aarts et al., 2005; Wegner, et al., 2004), in case of outcome priming, 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 that the matching process underlying self-agency effects based on goals. An important reason for this is that 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 closely to each other. In other words, outcome primes may 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. Consequentially, 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 pre-activated 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 Experiments 5.1 and 5.2 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 both enhance experienced self-agency for matches compared to mismatches, only goals decrease the sense of agency over mismatches. We conducted two experiments that test this prediction in a task where actual outcomes spatially (Experiment 5.1) or categorically (Experiment 5.2) match or mismatch with either a goal or an outcome prime.

In Experiment 5.3, 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 is expected to gradually decrease and approache 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 5.1

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 vs. match) by 2 (type of pre-activation: goal vs. prime) within-participant design.

Experimental task and procedure. In this experiment, we used the wheel of fortune paradigm (see Aarts et al., 2005; for a visualization of the task, see Figure 5.1). 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 8 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. 100 ms after participants pressed the STOP-key, one of the eight tiles turned black. This black tile was presented for 1 second 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 8 tiles of the path; twice for each of the four (goal mismatch, goal match, prime mismatch, and prime match) within-participant 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 seconds, 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 progress as described above.

All participants were presented with 32 goal trials and 32 prime trials in separate blocks, the order of which was counterbalanced between subjects. Within a block, trials were randomly presented. In between the

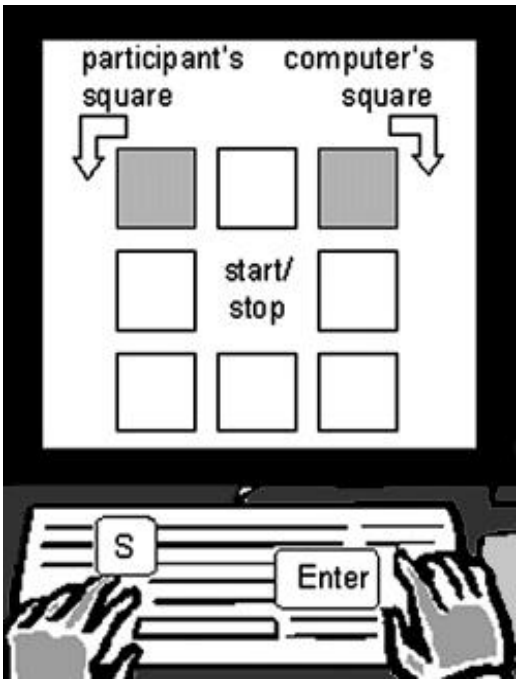

Figure 5.1. Visualization of the wheel of fortune task, showing how the squares move in opposite direction.

blocks participants received the relevant instructions concerning the goal or prime trials to make sure they knew what they had to do.

Outcome primes. On prime trials, participants were primed with outcome information just (67 ms) before they had to stop the moving squares. On 16 of these trials, a black square was flashed for 17 ms on the position on which the square would eventually stop. On another 16 trials, participants were primed with mismatching outcome information, i.e., 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. On 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 seconds in which also the warning signal was presented. On 16 trials, the actual outcome matched this location, and on another 16 trials the actual outcome mismatched. During the 17 ms in which an outcome was primed on 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 either 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, Aarts, & Ruys, 2010; 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 yield a main or interaction effect with the other factors in the design. Hence, the factor order 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) x 2 (type of pre-activation: goal vs. prime) repeated measures 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 interaction effect between matching and type of pre-activation emerged, F (1, 39) = 7.43, $p = .01$, $\eta_p^2 = .16$. There was no main effect of type of pre-activation, F (1, 39) = 1.79, $p = .19$, $\eta_p^2 = .04$.

To gain further insight into 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 , η_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, η_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, η_p^2 = .39) and the goal condition (F (1, 39) = 40.31, p < .001, η_p^2 = .51). The means for each cell in the design are presented in Figure 5.2.

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 infer 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 the 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

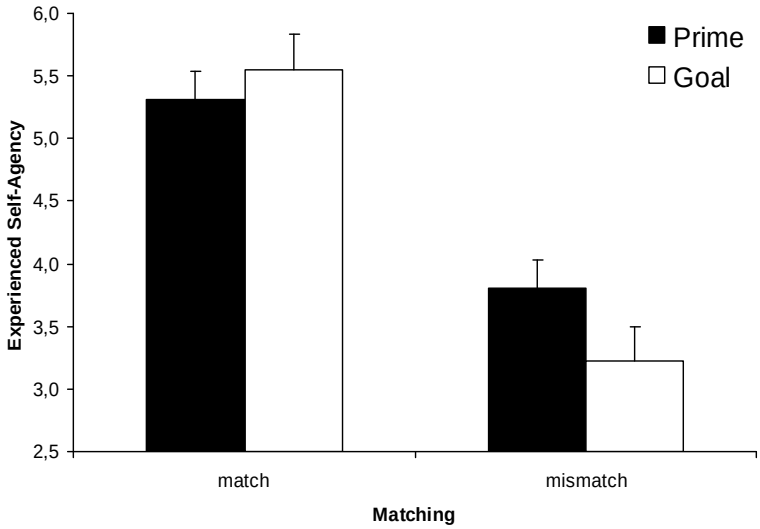

Figure 5.2. Experienced self-agency over outcomes that spatially matched or mismatched either a goal or a prime, Experiment 5.1. Error bars represent standard errors of the means.

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 pre-activation (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 pre-activation condition) before we conducted the required analyses. The ANCOVA analysis with subject as repeated factor, and matching and type of pre-activation as fixed factors yielded the same pattern of results as before: pre-activation ($F < 1$), 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 the 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 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 pre-activation 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 three seconds 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

[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, η_p^2 = .37. Planned contrast analyses revealed that agency ratings where higher when a matching outcome was primed (M = 5.47, SD = .99) than when a mismatching outcome was primed (M = 4.61, SD = 1.39), F (1,21) = 4.67, p = .04, η_p^2 = .18, and when no outcome was primed (M = 4.87, SD = 1.42), F (1, 21) = 4.62, p = .04, η_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 only rely on matches and not on mismatches between primed and actual outcomes.

(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-subject 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 pre-activated 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 were 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 they differed from primes in shaping experiences of self-agency.

Experiment 5.2

Experiment 5.2 served two main purposes. First, we aimed to conceptually replicate the findings of Experiment 5.1 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 5.1 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 5.1 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 5.1 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.

For this purpose, we used a task in which 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) x 2 (type of pre-activation: goal vs. prime) within-subject 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 5.3). Each trial started with a warning signal (i.e., 'pay attention' presented for 3000 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. 100 ms after each stop, one of four object words (glass, soap, fork, mint) would appear in the middle of the screen for 1 second. 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) x 2 (type of pre-activation: goal vs. prime) design. The experimental task thus consisted of 32 trials. As in Experiment 5.1, type of pre-activation (goal vs. prime) was manipulated in two blocks and the order in which participants received the blocks was counterbalanced between participants.

Outcome priming. On 8 of the 16 prime trials, the name of the matching object word (in capital letters) was primed for 30 ms within the presentation stream of letter strings (for a subliminality check of this procedure, see Aarts et al., 2009). On the other 8 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

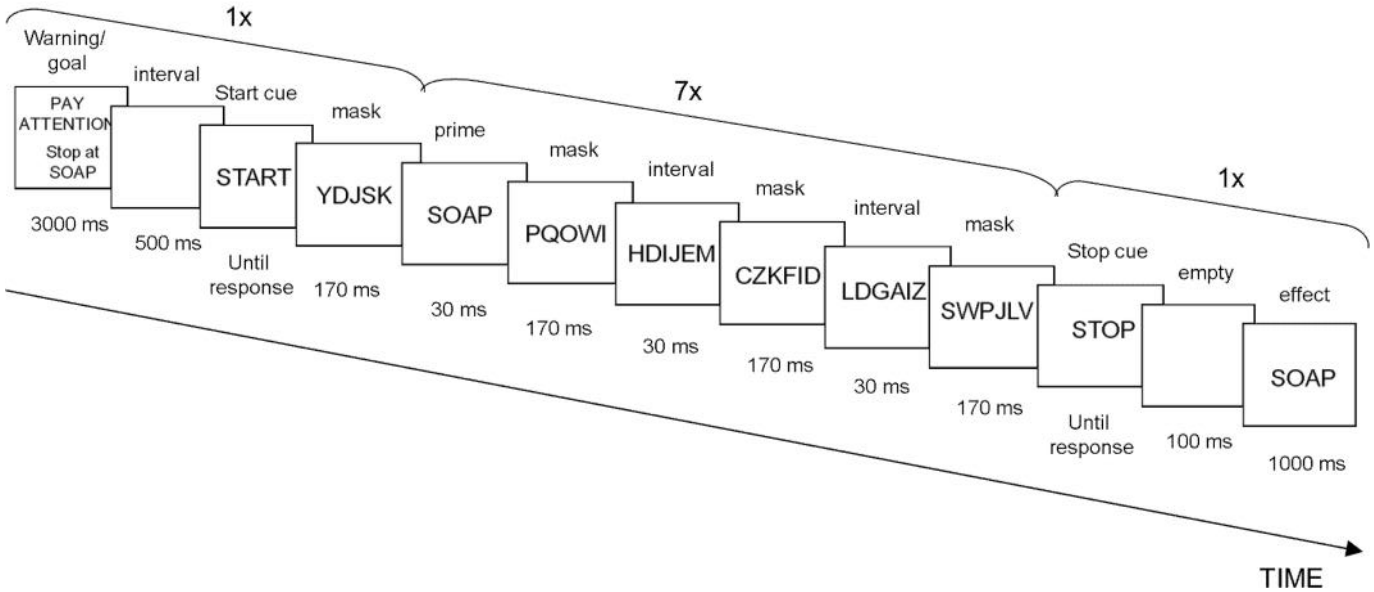

Figure 5.3. Schematic example of a goal matching trial of the action-outcome task of Experiment 5.2.

random letter string containing six characters was presented during this interval. On 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 post masks 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. On the 16 goal trials, participants were instructed before each trial to stop on a specific object word. This goal either matched (same object; on 8 trials) or mismatched (randomly selected other object; on the other 8 trials) the actual action-outcome. The goal instruction was presented at the beginning of each trial during the three seconds in 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) x 2 (type of pre-activation: 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 pre-activation, F (1, 63) =1.21, $p = .28$, $\eta_p^2 = .02$.

To gain further insight into 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, η_p^2 = .10. The means of the match and mismatch trials in both the goal and prime conditions are presented in Figure 5.4.

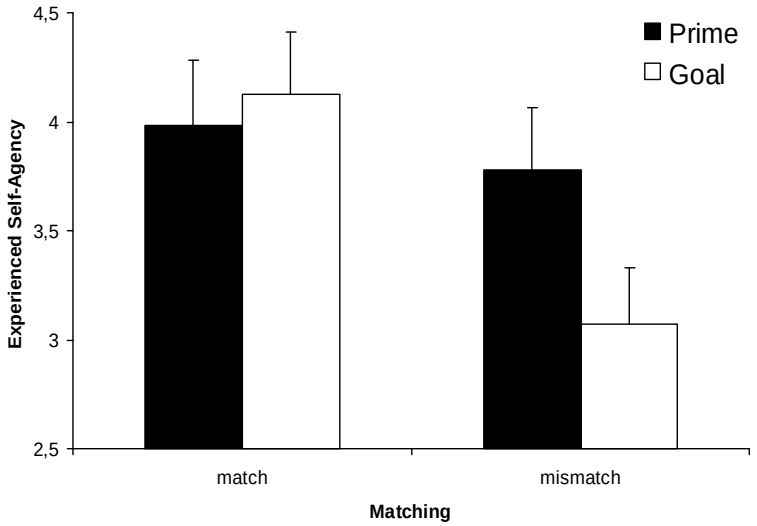

Figure 5.4. Experienced self-agency over outcomes that semantically matched or mismatched either a goal or an outcome prime, Experiment 5.2. Error bars represent standard errors of the means.

Discussion

In line with Experiment 5.1 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 5.1, 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 pre-activated outcome and the observed outcome. These results thus conceptually replicate, but also extend the findings of Experiment 5.1, by showing that outcomes that mismatch on a semantic level also affect self-agency differently for goals and outcome primes.

Experiment 5.3

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 5.3 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 pre-activated 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 5.2 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 can be based solely on the overlap between the representation of the pre-activated 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) x 2 (type of pre-activation: goal vs. prime) within-participants design.

Experimental task and procedure. The task and procedure employed in this experiment were similar to those of Experiment 5.1, 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 pre-activation 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 pre-activation 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 pre-activation (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 pre-activation and matching (F (4, 38) = 4.84, p = .003, ηp2 = .34). The means for each cell in the design are presented in Figure 5.5.

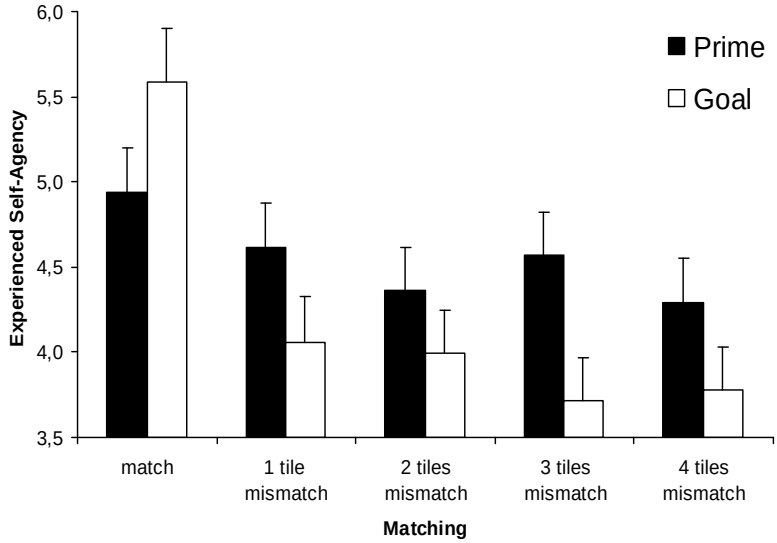

Figure 5.5. Experienced self-agency over outcomes that mismatched to an increasing degree with either a goal or a prime, Experiment 5.3. Error bars represent standard errors of the means.

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.

First of all, to corroborate the findings of Experiments 5.1 and 5.2, we analyzed the effect of type of outcome activation for matching and maximally mismatching (4 tiles discrepancy) outcomes. This analysis revealed a main effect of matching (F (1, 41) = 34.91, p < .001, η_p^2 = .46)

and no effect of type of pre-activation ($F < 1$). These effects were qualified by a significant interaction between type of pre-activation and matching (F (1, 41) = 9.76, p = .003, η_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, η_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, η_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, η_p^2 = .14) and the goal condition (F (1, 41) = 34.79, $p < .001$, η_p^2 = .46).

Pattern analyses. To gain more insight into 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, n.s., suggesting that the course of decrease in experienced self-agency in the prime condition is both linear and immediate.

Discussion

The results of Experiment 5.3 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 5.5). 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 5.3 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., Wegner & Wheatley, 1999; Aarts et al., 2005). That is, experienced self-agency results from inferences that we draw from our purposes of engaging 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 pre-activated 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 examining this issue shows that motor predictions and cognitive inferences independently affect experiences of self-agency (e.g., Moore, Wegner, 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 pre-activation of outcome information through goals and primes affects experienced self-agency even when motor prediction and control are 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 pre-activated outcome originates from goals or primes. For example, our current findings raise the novel question 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*' (Weinberg, 1996; p. 4, italics added), 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, Wegner, 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 then 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 over-attribute 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, emotion 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 pre-activation of outcomes (prime vs. goals) impacts 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., Patall, Cooper, & Robinson, 2008; Deci & Ryan, 2000). 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., Ryan & Deci, 2006; DeCharms, 1968; Leotti, Iyengar, & Ochsner, 2011). 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 of engaging 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. (2007a). On the emergence of human goal pursuit: The nonconscious regulation and motivation of goals. *Social Psychology and Personality Compass*, 183–201.

Aarts, H. (2007b). Unconscious authorship ascription: The effects of success and effect-specific information priming on experienced authorship. *Journal of Experimental Social Psychology, 43*, 119-126.

Aarts, H. (2012). Goals, motivated social cognition and behavior. In S. Fiske & C. N. Macrae (Eds.), *Handbook of Social Cognition.* London: Sage Publication Ltd.

Aarts, H., & Custers, R. (2009). Habit, action and consciousness (2009). In W. P. Banks (Ed.), *Encyclopaedia of Consciousness* (vol. 1, pp. 315-328). Oxford, UK: Elsevier Ltd.

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.

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.

Aarts, H., & Dijksterhuis, A. (2000). Habits as knowledge structures: Automaticity in goal-directed behavior. *Journal of Personality and Social Psychology, 78*, 53-63.

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

Aarts, H., Gollwitzer, P. M., & Hassin, R. R. (2004). Goal contagion: Perceiving is for pursuing. *Journal of Personality and Social Psychology, 87*, 23-37.

Aarts, H. & Hassin, R. (2005). Automatic goal inferences and contagion: On pursuing goals one perceives in other people's behavior. In J. P. Forgas, D. D. Williams, & W. Von Hippel, (Eds.), *Social motivation: Conscious and unconscious processes* (pp. 153-167). New York: 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.

Aarts, H., & Van den Bos, K. (2011). On the foundations of beliefs in free will: Intentional binding and unconscious priming in self-agency. *Psychological Science, 22*, 532-537.

Ackerman, J. M., Goldstein, N. J., Shapiro, J. R., & Bargh, J. A. (2009). You wear me out: The vicarious depletion of self-control. *Psychological Science, 20*, 326-332.

Aiken, L. S., & West, S. G. (1991). *Multiple Regression: Testing and interpreting interactions.* Newbury Park, CA: Sage.

Alloy, L. B., & Abramson, L. Y. (1979). The judgment of contingency in depressed and nondepressed students: Sadder but wiser? *Journal of Experimental Psychology: General, 108*, 441-485.

Altgassen, M., Kliegel, M., & Martin, M. (2008). Event-based prospective memory in depression: The impact of cue focality. *Cognition and Emotion, 23*, 1041-1055.

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

Bar Anan, Y., Wilson, T., & Hassin, R. R. (2010) Inaccurate self-knowledge formation as a result of automatic behavior. *Journal of Experimental Social Psychology, 46*, 884-894.

Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. *American Psychologist, 54,* 462–479.

Bargh, J. A., Gollwitzer, P. M., & Oettingen, G. (2010). Motivation. In S. T. Fiske, D. T. Gilbert, & G. Lindzey (Eds.), *Handbook of Social Psychology* (pp. 268-316). New York, NY: Wiley.

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. Kruglanski & E.T. Higgins (Eds.), *Social Psychology: Handbook of basic principles* (pp. 516-539). New York: Guilford Press.

Bayliss, A. P., Frischen, A., Fenske, M. J., & Tipper, S. P. (2007). Affective evaluations of objects are influenced by observed gaze direction and emotional expression. *Cognition, 104,* 644-653.

Belayachi, S., & Van der Linden, M. (2009). Level of agency in sub-clinical checking. *Consciousness and Cognition, 18,* 293-299.

Belayachi, S., & Van der Linden, M. (2010). Feeling of doing in obsessive-compulsive checking. *Consciousness and Cognition, 19,* 534-546.

Blakemore, S.-J., Smith, J., Steel, R., Johnstone, E., & Frith, C. D. (2000). The perception of self-produced sensory stimuli in patients with auditory hallucinations and passivity experiences: Evidence for a breakdown in self-monitoring. *Psychological Medicine, 30,* 1131-1139.

Blakemore, S.-J., Wolpert, D. M., & Frith, C.D. (1998). Central cancellation of self-produced tickle sensation. *Nature Neuroscience, 1,* 635-640.

Blakemore, S.-J., Wolpert, D. M., & Frith, C. D. (2002). Abnormalities in the awareness of action. *Trends in Cognitive Sciences, 6,* 237-242.

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.

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

Brewer, M. B., & Gardner, W. (1996). Who is this **"**we**"**? Levels of collective identity and self representations. *Journal of Personality and Social Psychology, 71, 83-93.*

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

Buehner, M. J., & Humphreys, G. R. (2009). Causal binding of actions to their effects. *Psychological Science, 20,* 1221-1228.

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

Chatlosh, D. L., Neunaber, D. J., & Wasserman, E. A. (1985). Response-outcome contingency: Behavioral and judgmental effects of appetitive and aversive outcomes with college students. *Learning and Motivation, 16,* 1-34.

Collins, A. M., & Loftus, E. F. (1975). A spreading-activation theory of semantic processing. *Psychological Review, 82,* 407-428.

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.

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.

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

Custers, R., & Aarts, H. (2011). Learning of predictive relations between events depends on attention, not on awareness. *Consciousness and Cognition, 20*, 368-378.

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.

Dannenberg, L., Förster, J., & Jostmann, N. B. (2012). "If only…": When counterfactual thoughts can reduce illusions of personal authorship. *Consciousness and Cognition, 21*, 456-463.

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.

Decety, J., Chaminade, T., Grèzes, J., & Meltzoff, A. N. (2002). A PET exploration of the neural mechanisms involved in reciprocal imitation. *NeuroImage, 15*, 265-272.

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.

Desantis, A., Roussel, C., & Waszak, F. (2011). On the influence of causal beliefs on the feeling of agency. *Consciousness and Cognition, 20*, 1211-1220.

Dickinson, A., & Shanks, D. (1995). Instrumental action and causal representation. In D. Sperber, D. Premack, & A. J. Premack (Eds.), *Causal Cognition: A Multidisciplinary Debate. Symposia of the Fyssen Foundation* (pp. 5-25). New York, NY: Clarendon Press/Oxford University Press.

Dijksterhuis, A., & Aarts, H. (2010). Goals, attention, and (un)consciousness. *Annual Review of Psychology, 16*, 467-490.

Dijksterhuis, A., & Bargh, J. A. (2001). The perception-behavior expressway: Automatic effects of social perception on social behavior. *Advances in Experimental Social Psychology, 33,* 1-40.

Dik, G., & Aarts, H. (2007). Behavioral cues to others' motivation and goal-pursuits: The perception of effort facilitates goal inference and contagion. *Journal of Experimental Social Psychology, 43,* 727-737.

Dogge, M., Schaap, M., Custers, R., Wegner, D. M., & Aarts, H. (2012). When moving without volition: Implied self-causation enhances binding strength between involuntary actions and effects. *Consciousness and Cognition, 21*, 501-506.

Ebert, J. P., & Wegner, D. M. (2010). Time warp: Authorship shapes the perceived timing of actions and events. *Consciousness and Cognition, 19*, 481-489.

Einhorn, H. J., & Hogarth, R. M. (1986). Judging probable cause. *Psychological Bulletin, 99,* 3-19.

Engbert, K., & Wohlschläger, A. (2007). Intentions and expectations in temporal binding. *Consciousness and Cognition, 16*, 255-264.

Engbert, K., Wohlschläger, A., & Haggard, P. (2008). Who is causing what? The sense of agency is relational and efferent-triggered. *Cognition, 107*, 693-704.

Fadiga, L., Fogassi, L., Pavesi, G., & Rizzolatti, G. (1995). Motor facilitation during action observation: a magnetic stimulation study. *Journal of Neurophysiology, 73*, 2608-2611.

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* (Vol. 2, pp. 490-515). New York, NY: Guilford Press.

Fitzsimons, G. M., & Finkel, E. J. (2010). Interpersonal influences on self-regulation. *Current Directions in Psychological Science, 19, 101-105.*

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.

Fourneret, P., & Jeannerod, M. (1998). Limited conscious monitoring of motor performance in normal subjects. *Neuropsychologia, 36,* 1133-1140.

Franck, N., Farrer, C., & Georgieff, N. (2001). Defective recognition of one's own actions in patients with schizophrenia. *American Journal of Psychiatry, 158,* 454-460.

Friedman, R., Deci, E. L., Elliot, A. J., Moller, A. C., & Aarts, H. (2010). Motivational synchronicity: Priming motivational orientations with observations of others' behaviors. *Motivation and Emotion, 34,* 34-38.

Frith, C. (2005). The neural basis of hallucinations and delusions. *Current Review of Biology, 328,* 169-175.

Frith, C. D., Blakemore, S.-J., & Wolpert, D. M. (2000a). Abnormalities in the awareness and control of action. *Philosophical Transactions of the Royal Society of London, 355,* 1771-1788.

Frith, C. D., Blakemore, S.-J., & Wolpert, D. M. (2000b). Explaining the symptoms of schizophrenia: abnormalities in the awareness of action. *Brain Research Reviews, 31,* 357-363.

Frith, C. D., & Done, D. J. (1989). Experiences of alien control in schizophrenia reflect a disorder in the central monitoring of action. *Psychological Medicine, 19*, 359-363.

Furr, R. M., & Rosenthal, R. (2003). Repeated-measures contrasts for "multiple-pattern" hypotheses. *Psychological Methods, 8*, 275-293.

Gallistel, C. R. (1985). Motivation, intention, and emotion: Goal-directed behavior from a cognitive-neuroethological point of view. In M. Frese & M. Sabini (Eds.), *Goal-directed behavior: The concept of action in psychology* (pp. 48-66). Hillsdale, NJ: Erlbaum.

Gentsch, A., & Schütz-Bosbach, S. (2011). I did it: Unconscious expectation of sensory consequences modulates the experience of self-agency and its functional signature. *Journal of Cognitive Neuroscience, 23*, 3817-3828.

Gollwitzer, P. M., & Kinney, R. F. (1989). Effects of deliberative and implemental mind-sets on illusion of control. *Journal of Personality and Social Psychology, 56*, 531-542.

Haggard, P. (2005). Conscious intention and motor cognition. *Trends in Cognitive Sciences, 9*, 290–295.

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

Haggard, P., Clark, S., & Kalogeras, J. (2002). Voluntary action and conscious awareness. *Nature Neuroscience, 5*, 382-385.

Henry, J. D., Rendell, P. G., Kliegel, M., & Altgassen, M. (2007). Prospective memory in schizophrenia: Primary or secondary impairment? *Schizophrenia Research, 95*, 179–185.

Hume, D. (1888). *A treatise of human nature*. London: Oxford University Press.

Jeannerod, M. (2003). The mechanism of self-recognition in humans. *Behavioral Brain Research, 142*, 1–15.

Jeannerod, M. (2006). *Motor cognition: What actions tell the self.* New York, NY: Oxford University Press.

Jeannerod, M., & Frak, V. G. (1999). Mental imaging of motor activity in humans. *Current Opinion in Neurobiology, 9,* 735–739.

Jenkins, H. M., & Ward, W. C. (1965). Judgement of contingency between responses and outcomes. *Psychological Monographs, 79,* 1-17.

Jeong, J. M., & Cranney, J. (2009). Motivation, depression, and naturalistic time-based prospective remembering. *Memory, 17,* 732-741.

Jones, S. R., de-Wit, L., Fernyhough, C., & Meins, E. (2008). A new spin on the wheel of fortune: Priming of action-authorship judgements and relation to psychosis-like experiences. *Consciousness and Cognition, 17,* 576-586.

Kelly, H. H. (1972). Attribution in social interaction. In E. E. Jones, D. E. Kanouse, H. H. Kelly, R. E. Nisbett, S. Valins, & B. Weiner (Eds.), *Attribution: Perceiving the causes of behavior* (pp.1-26). Morristown, NJ: General Learning Press.

Knoblich, G., Stottmeister, F., & Kircher, T. T. J. (2004). Self-monitoring in patients with schizophrenia. *Psychological Medicine, 34,* 1561-1569.

Kozak, M. N., Marsh, A. A., & Wegner, D. M. (2006). What do I think you're doing? Action identification and mind attribution. *Journal of Personality and Social Psychology, 90,* 543-555.

Lebreton, M., Kawa, S., d'Arc, B. F., Daunizeau, J., & Pessiglione, M. (2012). Your goal is mine: Unraveling mimetic desires in the human brain. *The Journal of Neuroscience, 32,* 7146-7157.

Leotti, L. A., Iyengar, S. S., & Ochsner, K. N. (2011). Born to choose: The origins and value of the need for control. *Trends in Cognitive Sciences, 14,* 457-463.

Lickel, B., Schmader, T., Curtis, M., Scarnier, M., & Ames, D. R. (2005). Vicarious shame and guilt. *Group Processes and Intergroup Relations, 8,* 145-157.

Linser, K., & Goschke, T. (2007). Unconscious modulation of the conscious experience of voluntary control. *Cognition, 104,* 459-475.

Loersch, C., Aarts, H., Payne, B. K., & Jefferis, V. E. (2008). The influence of social groups on goal contagion. *Journal of Experimental Social Psychology, 44,* 1555-1558.

Martin, L. E., & Potts, G. F. (2009). Impulsivity in decision-making: An event-related potential investigation. *Personality and Individual Differences, 46,* 303-308.

McClure, J. (1998). Discounting causes of behavior: Are two reasons better than one? *Journal of Personality and Social Psychology, 74,* 7-20.

McKone, E. (1995). Short-term implicit memory for words and nonwords. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21,* 1108-1126.

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

Milgram, S. (1963). Behavioral study of obedience. *Journal of Abnormal and Social Psychology, 67,* 371-378.

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

Moore, J. W., & Haggard, P. (2008). Awareness of action: Inference and prediction. *Consciousness and Cognition, 17,* 136-144.

Moore, J. W., Lagnado, D., Deal, D. C., & Haggard, P. (2009). Feelings of control: Contingency determines experience of action. *Cognition, 110,* 279-283.

Moore, J. W., & Obhi, S. S. (2012). Intentional binding and the sense of agency: A review. *Consciousness and Cognition, 21,* 546-561.

Moore, J. W., Wegner, D. M., & Haggard, P. (2009). Modulating the sense of agency with external cues. *Consciousness and Cognition, 18*, 1056-1064.

Moskowitz, G. B. (2002). Preconscious effects of temporary goals on attention. *Journal of Experimental Social Psychology, 38*, 397-404.

Moskowitz, G. B., Li, P., & Kirk R. (2004). The implicit volitional model: On the preconscious regulation of temporarily adopted goals. *Advances in Experimental Social Psychology, 36*, 317-413.

Nattkemper, D., & Ziessler, M. (2004). Cognitive control of action: The role of action effects. *Psychological Research, 68*, 71-73.

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

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.

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review, 84*, 231-259.

Pacherie, E. (2008). The phenomenology of action: A conceptual framework. *Cognition, 107*, 179-217.

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.

Piaget, J. (1954). *The construction of reality in the child*. New York: Basic Books.

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

Prinz, W. (1997). Perception and action planning. *European Journal of Cognitive Psychology, 9,* 129-154.

Preston, C., & Newport, R. (2010). Self-denial and the role of intentions in the attribution of agency. *Consciousness and Cognition, 19,* 986-998.

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.

Rizzolatti, G., & Craighero, L. (2004). The mirror-neuron system. Annual Review of Neuroscience, 27, 169-192.

Rochat, P., & Striano T. (2000). Perceived self in infancy. *Infant Behavior and Development, 23,* 513-530.

Ruys, K. I., & Aarts, H. (2010). When competition merges people's behavior: Interdependency activates shared action representations. *Journal of Experimental Social Psychology, 46,* 1130-1133.

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.

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.

Sato, A. (2009). Both motor prediction and conceptual congruency between preview and action-effect contribute to explicit judgment of agency. *Cognition, 110,* 74-83.

Sato, A., & Yasuda, A. (2005). Illusion of self-agency: Discrepancy between the predicted and actual sensory consequences of actions modulates the sense of self-agency, but not the sense of self-ownership. *Cognition, 94,* 241–255.

Sebanz, N., Bekkering, H., & Knoblich, G. (2006). Joint action: Bodies and minds moving together. *Trends in Cognitive Sciences, 10,* 70-76.

Shanks, D. R., & Dickinson, A. (1991). Instrumental judgment and performance under variations in action-outcome contingency and contiguity. *Memory and Cognition, 19*, 353-360.

Shepperd, J. A., Malone, W., & Sweeny, K. (2008). Exploring causes of the self-serving bias. *Social and Personality Psychology Compass, 2*, 895–908.

Soon, C. S., Brass, M., Heinze, H.-J., & Haynes, J.-D. (2008). Unconscious determinants of free decisions in the human brain. *Nature Neuroscience, 11*, 543-545.

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.

Steinhauser, M., & Kiesel, A. (2011). Performance monitoring and the causal attribution of errors. *Cognitive, Affective, & Behavioral Neuroscience, 11*, 309-320.

Synofzik, M., Vosgerau, G., & Lindner, A. (2009). Me or not me - an optimal integration of agency cues? *Consciousness and Cognition, 18,* 1065-1068.

Synofzik, M., Vosgerau, G., & Newen, A. (2008). Beyond the comparator model: A multifactorial two-step account of agency. *Consciousness and Cognition, 17*, 219-239.

Taylor, S. E., & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin, 103,* 193-210.

Tetlock, P. E., & Levi, A. (1982). Attribution bias: On the inconclusiveness of the cognition-motivation debate. *Journal of Experimental Social Psychology, 18*, 68-88.

Tomasello, M., & Carpenter, M. (2007). Shared intentionality. *Developmental Science, 10,* 121-125.

Tropp, L. R., & Wright, S. C. (2001). Ingroup identification as the inclusion of ingroup in the self. *Personality and Social Psychology Bulletin, 27*, 585-600.

Twamley, E. W., Woods, S. P., Zurhellen, C. H., Vertinski, M., Narvaez, J. M., Mausbach, B. T., Patterson, T. L., & Jeste, D. V. (2008). Neuropsychological substrates and everyday functioning implications of prospective memory impairment in schizophrenia. *Schizophrenia Research, 106*, 42-49.

Vallacher, R. R., & Wegner, D. M. (1985). *A theory of action identification.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Vallacher, R. R., & Wegner, D. M. (1987). What do people think they're doing? Action identification and human behavior. *Psychological Review, 94*, 3-15.

Vallacher, R. R., & Wegner, D. M. (1989). Levels of personal agency: Individual variation in action identification. *Journal of Personality and Social Psychology, 57*, 660-671.

Vallacher, R. R., Wegner, D. M., McMahan, S. C., Cotter, J., & Larsen, K. A. (1992). On winning friends and influencing people: Action identification and self-presentation success. *Social Cognition, 10*, 335-355.

Vohs, K. D., & Schooler, J. W. (2008). The value of believing in free will: Encouraging a belief in determinism increases cheating. *Psychological Science, 19*, 49-54.

Walker, E., Kestler, L., Bollini, A., & Hochman, K. M. (2004). Schizophrenia: Etiology and course. *Annual Review of Psychology, 55*, 401-430.

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.

Wegner, D. M., & Vallacher, R. R. (1986). Action identification. In R. M. Sorrentino & E. T. Higgins (Eds.), *Handbook of motivation and cognition: Foundations of social behavior* (pp. 550-582). New York, NY: Guilford.

Wegner, D. M., Vallacher, R. R., Macomber, G., Wood, R., & Arps, K. (1984). The emergence of action. *Journal of Personality and Social Psychology, 46,* 269-279.

Wegner, D. M., & Wheatley, T. P. (1999). Apparent mental causation: Sources of the experience of will. *American Psychologist, 54,* 480-492.

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.

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.

van der Weiden, A., Ruys, K. I., & Aarts, H. (2012, September 17). A matter of matching: How goals and primes affect self-agency experiences. *Journal of Experimental Psychology: General.* Advance online publication. doi: 10.1037/a0030079.

van der Weiden, A., Aarts, H., & Ruys, K. I. (submitted). On the nature of experiencing self-agency: inferring oneself as the cause of intended and unintended outcomes.

van der Weiden, A., Veling, H., & Aarts, H. (2010). When observing gaze shifts of others enhances object desirability. *Emotion, 10,* 939-943.

Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review, 92,* 548-573.

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.

Wenke, D., Fleming, S. M., & Haggard, P. (2010). Subliminal priming of actions influences sense of control over effects of action. *Cognition, 115*, 26-38.

Wolpert, D. M., & Flanagan, J. R. (2001). Motor prediction. *Current Biology, 11*, 729-732.

Samenvatting – Summary in Dutch

In het dagelijks leven voeren we als mensen continu acties uit die uitkomsten veroorzaken in onze directe omgeving. We zwaaien bijvoorbeeld naar een taxi, en de taxi stopt voor ons; we drukken op de knop voor de lift, en de lift komt naar beneden; of we vertellen een grap en de mensen om ons heen beginnen te lachen. Of het nu gaat om het simpelweg bewegen van onze vingers, het indrukken van een knop of het vertellen van een grap, we ervaren doorgaans dat we deze acties en de uitkomsten die daaruit volgen zelf veroorzaken. Deze ervaring wordt ook wel de ervaring van zelf-causatie genoemd.

Zulke zelf-causatie ervaringen lijken heel vanzelfsprekend. We denken vaak heel goed te weten of we bepaalde acties en uitkomsten zelf veroorzaakt hebben of niet. Echter, in veel (vooral sociale) situaties is dit niet zo voor de hand liggend. De lift kan bijvoorbeeld ook naar beneden komen omdat iemand in de lift op de knop naar beneden heeft gedrukt. En de mensen om ons heen kunnen ook beginnen te lachen omdat er net iemand voorbij loopt met een raar kapsel.

Het wel of niet ervaren van zelf-causatie over dergelijke acties en uitkomsten heeft belangrijke gevolgen voor hoe we onszelf zien. Ook beïnvloed het onze gevoelens van controle over onze omgeving en over ons toekomstige gedrag. Naast deze zelfregulerende functie is de ervaring dat we zelf de oorzaak zijn van onze acties en uitkomsten belangrijk voor sociale interactie. Immers, als we bijvoorbeeld niet zouden weten of we zelf een bepaalde uitkomst hebben veroorzaakt, of dat iemand anders dat heeft gedaan, dan zouden we ook niet weten of we iemand moeten bedanken, beschuldigen, of onze excuses moeten aanbieden. Bovendien is de ervaring van zelf-causatie geassocieerd met welzijn en geluk, en zijn

stoornissen in het ervaren van zelf-causatie geassocieerd met mentale gezondheidsproblemen zoals obsessief compulsief controle gedrag en auditieve hallucinaties (het horen van stemmen) of het gevoel aangestuurd te worden door externe factoren zoals sommige schizofreniepatiënten dat ervaren.

Aangezien de ervaring van zelf-causatie niet vanzelfsprekend is en belangrijke gevolgen heeft voor zelf en ander, is het belangrijk te begrijpen wanneer en hoe de ervaring van zelf-causatie tot stand komt.

DE ROL VAN DOELEN

In eerste instantie hebben onderzoekers zich bij het beantwoorden van deze vraag vooral gericht op de rol van bewuste intenties tot het behalen van een doel. Het uitgangspunt was dat mensen een causale relatie veronderstellen tussen hun intenties en hun gedrag en de daaruit volgende uitkomsten. Dat wil zeggen: mensen voeren bepaalde handelingen uit *omdat* ze daarmee een bepaalde uitkomst willen veroorzaken. Wanneer die gewenste uitkomst dan inderdaad optreedt, dan ervaart men doorgaans dat men die uitkomst zelf heeft veroorzaakt. De overeenkomstigheid van de uitkomst die men voor ogen had en de uitkomst die daadwerkelijk optreedt, staat dan ook centraal in modellen over de totstandkoming van zelf-causatie ervaringen.

Echter, recente ontwikkelingen op het gebied van psychologie en neurowetenschap wijzen uit dat gedrag veelal wordt geïnitieerd en aangestuurd door onze omgeving, buiten ons bewustzijn, en dus in de afwezigheid van bewuste intenties. Toch ervaren mensen over het algemeen ook zelf-causatie over de uitkomsten van dit niet-intentionele gedrag. Een verklaring die hiervoor geopperd is, is dat ook op onbewust niveau de uitkomsten van onze acties worden vergeleken met uitkomstinformatie die op het moment van actie actief was in het

geheugen. Dit blijkt inderdaad het geval te zijn. Recente studies laten namelijk zien dat het onbewust aanbieden van uitkomstinformatie aan participanten, ook wel priming genoemd, leidt tot verhoogde ervaringen van zelf-causatie over uitkomsten die overeen komen met deze uitkomstinformatie.

Het lijkt dus alsof dit onbewust activeren van uitkomstinformatie, of primen, hetzelfde werkt als het hebben van een bewuste intentie. In beide gevallen ervaart men meer zelf-causatie als een actie-uitkomst hiermee overeen komt. Er zijn echter een aantal belangrijke verschillen tussen intenties en primes die mogelijk invloed hebben op hoe en wanneer de ervaring zelf de oorzaak te zijn van een uitkomst tot stand komt. Zo speelt kennis over de waarschijnlijkheid waarmee een bepaalde actie een bepaalde uitkomst veroorzaakt wellicht een belangrijkere rol wanneer iemand probeert een doel te behalen dan wanneer diegene slechts geprimed is met uitkomstinformatie. Ook zijn mensen waarschijnlijk meer gericht op de uitkomsten van hun acties wanneer ze een doel hebben dan wanneer ze geprimed zijn. In de huidige dissertatie zijn deze verschillen tussen doelen en primes en hun uitwerking op de ervaring van zelf-causatie onderzocht. Hoofdstukken 1 en 2 vormen een inleiding tot de empirische hoofdstukken (Hoofdstukken 3 tot 5). In Hoofdstuk 1 wordt het onderzoek behorende tot deze dissertatie in een theoretische context geplaatst en wordt een overzicht gegeven van de verschillende hoofdstukken. In Hoofdstuk 2 wordt het onderzoek dat behandeld wordt in Hoofdstuk 3 tot en met 5 verder theoretisch ingebed en wordt uitgelegd hoe de ideeën die hierbij behandeld worden ondersteund worden door recent onderzoek.

ONDERSTEUNENDE EXPERIMENTEN

Causale kennis over actie-uitkomst relaties

Als het gaat om het onderscheiden of een uitkomst veroorzaakt is door je eigen acties of door de acties van anderen, dan is kennis over de causale relaties tussen acties en uitkomsten essentieel. Dit ligt voornamelijk voor de hand wanneer men doelgerichte, intentionele acties uitvoert. Immers, wanneer mensen het doel hebben een bepaalde uitkomst te behalen dan is het uiteraard van belang te weten welke actie met grote waarschijnlijkheid zal resulteren in de gewenste uitkomst. Wanneer mensen geen specifiek doel hebben, maar slechts geprimed zijn met een bepaalde uitkomst dan spelen acties en hun relatie met de uitkomsten die volgen wellicht een minder grote rol. Dit idee wordt ook ondersteund door onderzoek dat liet zien dat het primen van uitkomsten zelfs leidt tot sterkere zelf-causatie ervaringen wanneer men zelf geen actie heeft uitgevoerd. Aan de andere kant zou het toch een beetje raar zijn om zelf-causatie te ervaren over uitkomsten waarvan je weet dat de acties die je uitvoert geen causale relatie hebben met de daarop volgende uitkomsten (bijvoorbeeld wanneer het drukken op de ENTER-knop wordt gevolgd door een regenbui). Of kennis over actie-uitkomst relaties ook essentieel is bij priming effecten op de ervaring van zelf-causatie wordt onderzocht in de experimenten die staan beschreven in Hoofdstuk 3.

In dit onderzoek leerden participanten eerst de relaties tussen hun acties en de uitkomsten die daarop volgden. Een derde van de participanten leerde dat het drukken van een linkertoets met hoge waarschijnlijkheid (80%) gevolgd werd door de ene uitkomst (bijvoorbeeld het woord BOEK), terwijl het drukken van een rechtertoets met grote waarschijnlijkheid (80%) gevolgd werd door de andere uitkomst (bijvoorbeeld het woord GLAS). Een andere groep participanten leerde dat

er geen causale relatie was tussen hun acties en uitkomsten. Dat wil zeggen, of ze nu op de linker- of rechtertoets drukten, beide uitkomsten (de woorden BOEK en GLAS) kwamen even vaak voor (50%). En een laatste groep participanten leerde actie-uitkomst relaties die irrelevant waren voor de uitkomsten waarover zelf-causatie werd gemeten. Zij leerden dat hun acties geen causale relatie hadden met twee andere uitkomsten (de woorden ZEEP en KRIJT).

In de zelf-causatietaak zagen proefpersonen een zeer snelle opeenvolging van willekeurige letterreeksen waartussen *zogenaamd* de woorden BOEK en GLAS werden getoond, maar te snel om zichtbaar te zijn voor de proefpersonen. Op gegeven moment dienden participanten op een linker- of rechterknop te drukken, en het moment waarop ze drukten zou bepalen op welk woord (BOEK of GLAS) de opeenvolging van letterreeksen zou stoppen (net als bij een fruitautomaat waarbij men snel draaiende symbolen laat stoppen). Verder werd verteld dat de computer ook random kon bepalen op welk woord de letterreeksen zouden stoppen. Als maat voor ervaren zelf-causatie gaven participanten telkens aan in hoeverre ze het gevoel hadden dat zij zelf de letterreeksen op het betreffende woord hadden laten stoppen. Tijden de presentatie van de letterreeksen werd, om de ervaring van zelf-causatie te manipuleren, soms de uitkomst die zou volgen geprimed, en soms niet.

De resultaten van dit onderzoek lieten zien dat men sterk het gevoel had een uitkomst zelf veroorzaakt te hebben wanneer men had geleerd dat de uitkomst met grote waarschijnlijkheid volgde uit de actie die men had uitgevoerd (het stoppen met een linker- of rechterknop). Dit gevoel werd nog eens extra versterkt wanneer men ook geprimed was met de uitkomst. Wanneer men echter geleerd had dat er geen causale relatie bestond tussen het links of rechts drukken en de woorden GLAS en BOEK, dan ervoer men minder zelf-causatie en had het primen van uitkomsten ook

geen effect meer. Interessant is dat het primen van de uitkomsten GLAS en BOEK wel weer de ervaring van zelf-causatie verhoogde wanneer men geleerd had dat er geen causale relatie bestond tussen het links en rechts drukken en de irrelevante uitkomsten ZEEP en KRIJT. Dit toont aan dat het hebben van relevante kennis over causale relaties tussen acties en uitkomsten niet persé vereist is voor het effect van primes op ervaringen van zelf-causatie. Hierin verschillen doelen en primes mogelijk van elkaar. Aan de andere kant komen primes overeen met doelen in dat ze geen effect hebben op het ervaren van zelf-causatie over uitkomsten waarvan men weet dat die niet het gevolg kunnen zijn van de eigen acties.

Gedragsrepresentatie-niveaus

Een ander verschil tussen doelen en primes dat mogelijk invloed heeft op de ervaring van zelf-causatie komt tot uiting in de mate waarop men gericht is op de uitkomst van een actie. Wanneer men een doel heeft is het hoogstwaarschijnlijk dat men gericht is op de specifieke, gewenste uitkomst die men voor ogen heeft. Echter, wanneer men *geen* specifiek doel voor ogen heeft dan kan men het gedrag en de uitkomsten die daaruit volgen op meerdere manieren representeren. In plaats van gericht te zijn op *waarom* men een bepaalde actie uitvoert (in termen van de uitkomst van de actie) kan men ook meer gericht zijn op *hoe* men een bepaalde actie uitvoert (in termen van specifieke handelingen). Viool spelen kan bijvoorbeeld gerepresenteerd worden als het bewegen van de vingers, het produceren van geluiden, of het ontroeren van de luisteraars. Hoe men de uitkomsten van gedrag representeert beïnvloed mogelijk de mate waarin een actie-uitkomst wordt gezien als overeenkomstig met de uitkomst die men in het hoofd heeft, en dus ook of men daar zelf-causatie over ervaart. Dit idee werd getoetst door middel van 3 experimenten die staan vermeld in Hoofdstuk 4.

Participanten in dit onderzoek voerden een taak uit waarbij ze herhaaldelijk twee snel ronddraaiende blokjes op het computerscherm moesten laten stoppen (net als bij het rad van fortuin). Één van deze blokjes was van hun zelf en de ander was van de computer. Zodra ze de twee blokjes hadden gestopt werd slechts van één van de twee blokjes de stoplocatie getoond. Het was dus onduidelijk of dat de stoplocatie van hun eigen blokje, of dat van de computer was. Als maat van zelf-causatie werd de participanten gevraagd aan te geven in hoeverre ze het gevoel hadden dat zij hun blokje op die getoonde locatie hadden laten stoppen. Om hun ervaring van zelf-causatie te beïnvloeden werden ze kort voordat ze op een stop-knop moesten drukken geprimed met de uitkomst die vervolgens getoond zou worden. Dit werd gedaan door kort (zo kort dat ze het niet door hadden) het blokje te laten flitsen op de betreffende locatie. Bovendien werd het gedragsrepresentatie-niveau van de participanten ofwel gemeten of beïnvloed door in de instructies de nadruk te leggen op ofwel het drukken op de stop-knop (actie-focus), of het bepalen waar het eigen blokje zou gaan stoppen (uitkomst-focus).

Net als in eerder onderzoek bleek dat participanten meer zelf-causatie ervoeren over de uitkomst wanneer ze geprimed waren met de corresponderende uitkomst. Echter, de huidige bevindingen lieten tevens zien dat dit effect voornamelijk aanwezig was wanneer men het gedrag representeerde in termen van de uitkomst, en in mindere mate wanneer men het gedrag representeerde in termen van acties. Hieruit blijkt dat het hebben van een uitkomst-focus (zoals ook het geval is bij doelen) belangrijk is bij priming-effecten op ervaringen van zelf-causatie.

Doelen versus primes

De bevindingen uit onderzoek naar priming-effecten op de ervaring van zelf-causatie (waaronder ook het onderzoek in Hoofdstuk 3 en

4 van de huidige dissertatie) wekken de suggestie dat doelen en primes op een soortgelijke manier de ervaring van zelf-causatie beïnvloeden. Dit zou betekenen dat het hebben van een bewust doel geen toegevoegde waarde heeft. Toch zijn er een aantal cruciale processen die een rol spelen bij doelgericht gedrag en die simpelweg ontbreken wanneer men slechts geprimed is met uitkomstinformatie. Zo wordt wanneer men een doel heeft niet alleen de aandacht meer gericht op de uitkomst van de actie, ook wordt afleidende uitkomstinformatie onderdrukt, en wordt het relevant om in de gaten te houden of de gewenste uitkomst wel behaald wordt. Wanneer een uitkomst namelijk niet overeenkomt met het doel van een actie, dan zal men het gedrag moeten aanpassen om alsnog de gewenste uitkomst te kunnen bereiken. Is men slechts geprimed met een bepaalde uitkomst, dan wordt alternatieve uitkomstinformatie niet onderdrukt, maar zelfs geactiveerd zolang er een associatie bestaat tussen de geprimede uitkomst en de alternatieve uitkomst. Zo kan het concept 'peer' bijvoorbeeld ook het concept 'appel' activeren en kan (voor schaakspelers) het concept 'paard' ook het concept 'toren' activeren. Bovendien is het niet zo relevant of de geprimede uitkomst *niet* behaald wordt, aangezien men het toekomstig gedrag daar niet op aan hoeft te passen. Kortom, doelen en primes hebben mogelijk een ander effect op ervaringen van zelf-causatie over uitkomsten die niet overeenkomen met deze doelen of primes.

In Hoofdstuk 5 wordt het effect van de overeenkomstigheid van uitkomsten met doelen en primes op zelf-causatie ervaringen onderzocht door middel van 3 experimenten die gebruik maakten van verschillende zelf-causatietaken en verschillende gradaties van overeenkomstigheid. Dit onderzoek laat zien dat wanneer men het doel heeft een specifieke uitkomst te veroorzaken ervaringen van zelf-causatie ontstaan volgens een alles-of-niets principe. Dat wil zeggen dat men alleen zelf-causatie ervaart over uitkomsten die overeenkomen met het doel en men zelfs minder zelf-causatie ervaart over uitkomsten die niet overeenkomen met het doel dan

wanneer men geen doel zou hebben. Wanneer men geprimed is met een bepaalde uitkomst dan ervaart men zelf-causatie over een groter scala van uitkomsten. Hoewel men de meeste zelf-causatie ervaart over uitkomsten die volledig overeenkomen met de geprimede uitkomst, de ervaring van zelf-causatie is nog steeds verhoogd over uitkomsten die in enige mate geassocieerd zijn met de geprimede uitkomst. Doelen en primes beïnvloeden ervaringen van zelf-causatie dus via verschillende mechanismes. Deze bevinding heeft belangrijke implicaties voor huidige modellen over de totstandkoming van zelf-causatie ervaringen, maar ook voor processen die geassocieerd zijn met het behalen van doelen, zoals emotie en motivatie.

Slotopmerkingen

Recent onderzoek heeft aangetoond dat men geen bewuste intentie hoeft te hebben om zelf-causatie te kunnen ervaren over de uitkomsten van hun acties. In de huidige dissertatie heb ik bestudeerd wanneer en hoe de ervaring van zelf-causatie tot stand komt als gevolg van uitkomst-priming. Bovendien heb ik onderzocht hoe intenties en primes verschillen in hun effect op ervaringen van zelf-causatie. De bevindingen van dit onderzoek tonen aan dat hoewel doelen en primes overeenkomsten vertonen in hun effect op ervaren zelf-causatie op het gebied van causale kennis en gedragsrepresentatie, ze verschillende uitwerkingen hebben op uitkomsten die niet overeenkomen. Dit suggereert dat doelen en primes zelf-causatie ervaringen via verschillende mechanismes beïnvloeden. Deze bevindingen bieden aanknopingspunten voor vervolgonderzoek naar de werking van deze mechanismes en de implicaties voor onder andere zelf-perceptie, sociale interactie, en stoornissen in ervaringen van zelf-causatie.

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"Alone we can do so little; together we can do so much"
- Helen Keller

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Curriculum Vitae

Anouk van der Weiden was born in Utrecht on June 5th 1985. After graduating high school with a beta profile and drawing and music as electives, she wanted to know more about human behavior, something they do not teach in high school. In 2004, she started studying psychology at Utrecht University. In 2008, she obtained her master degree in social psychology (cum laude) on a project that addressed the effect of observed gaze shifts on object desirability. Enthusiastic about unraveling the foundations of human behavior, she then started on a PhD project at Utrecht University in which she examined how people arrive at the experience of being the cause of behavioral outcomes that they did or did not intend to obtain. This research resulted in several national and international publications, and the dissertation you are now reading. Currently, she works as a post-doc at the University Medical Center in Utrecht on a project that addresses the implications of experienced self-agency for social functioning in health and schizophrenia.

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