

# I Didn't Mean to Hurt You! Unconscious Origins of Experienced Self-Agency Over Others' Emotions

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Our conscious experiences of self-agency tell us that we cause and change other people's emotions during social interactions, even without awareness of what we did. How do such experiences of being the cause of an outcome, such as the emotions of others, emerge? Previous authorship ascription research suggests that unconsciously primed knowledge about emotions produces a sense of self-agency upon seeing the primed emotions expressed in another agent. Taking into account the crucial role of valence and the nature of one's own actions in understanding others' behaviors, we predicted that preactivated knowledge linked to a particular emotion, in terms of action or valence, increases experienced self-agency upon seeing the emotion in another agent. In four experiments, participants interacted with another agent and observed this agent's neutral expressions change into emotional expressions. Results showed that various kinds of subliminal primes enhance experienced self-agency over the observed emotions. Our findings support the idea that the unconscious authorship ascription process is less rigid when outcomes are socially meaningful.

*Keywords:* emotion, authorship ascription, priming, unconscious

Emotions play a vital role in social interactions. Emotional expressions of one's interaction partner provide feedback about their internal states. When we interact with others and perform actions that change the other person's emotions, we may experience ourselves to be the cause of the other person's emotion. These self-agency experiences enable people to distinguish between outcomes resulting from the actions of others and outcomes resulting from one's own actions, and to attribute these outcomes to the proper agent. Interestingly, although our conscious experiences of self-agency tell us that we cause and change other people's emotions during social interactions, it is less clear how such experiences of self-agency over others' emotions emerge. This question is particularly interesting because research shows that we are not always consciously aware of the causes of our own and other people's emotions (Lazarus, 1991; Öhman, 1992; Ruys & Stapel, 2008a; Winkielman & Berridge, 2004; Zajonc, 1980). That is, during social interaction, our own and others' emotions often change rapidly and unconsciously (Moody, McIntosh, Mann, & Weisser, 2007), suggesting that people are equipped with a social-cognitive mechanism tuned to easily signal oneself as the current agent for outcomes, such as the emotions of other people, regardless of whether or not one intended to produce these outcomes.

The present research explores how the conscious experience of self-agency over others' emotions may result from unconscious

sources. In line with previous work, we argue that the conscious experience of self-agency is an inference that occurs fluently and perfunctorily after action performance and is not accurate *per se* (see also Bargh, 2005; Wegner, 2002). This inferential character of experiences of self-agency has become apparent in a number of recent studies (Aarts, Custers, & Marien, 2009; Aarts, Custers & Wegner, 2005; Belayachi & van der Linden, 2009; Sato & Yasuda, 2005; Wegner & Wheatley, 1999), demonstrating that these experiences are the result of a match between the outcome of an action and knowledge about the outcome that was made active just prior to its occurrence.

Building on and extending this previous work, we examine how unconsciously primed knowledge about emotions produces the sense of self-agency upon seeing the primed emotions expressed in another agent. In particular, based on the idea that emotions are associatively linked with the actions that typically produce these emotions and with affective (e.g., negative valence) information, we argue that action or affective information can serve as an outcome representation during social interaction. Accordingly, priming this outcome information just before the outcome (e.g., an emotional expression of another agent) is produced should promote experiences of self-agency, whether one truly has caused the outcome or not. Moreover, because the unconscious authorship ascription process involved in social interactions is sensitive to action and affective information associated with emotions, the sense of self-agency over causing emotions in others may be augmented, even when the observed emotional expression does not exactly correspond with the knowledge preactivated in mind. We report four experiments to examine these important, intriguing ideas.

In research on the ascription of personal authorship, the view prevails that conscious intentions to produce a certain outcome play a crucial role in establishing our sense of causing that out-

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come (Bandura, 1986; Haggard, 2005; Jeannerod, 2003). Taking this assumption to the realm of social interactions, this would mean for example that when we intend to hurt someone and act accordingly (e.g., shout, hit), then observing that the person is angry or sad generally leads us to conclude that we have caused this hurt. This observation might seem trivial. More intriguing is the question of what happens when we had no conscious intention to hurt a person, but we observe that the person is hurt. What then determines the extent to which we experience to be the cause of the person's hurt? Recent findings show that we can even experience self-agency over outcomes without a prior intention to produce these outcomes. This work demonstrates that information that renders the representation of an outcome active before performing an action and observing the outcome may enhance experienced self-agency, even when this information is presented unconsciously through subliminal priming (e.g., Aarts, 2007; Aarts et al., 2005, 2009; Sato, 2009; Van der Weiden, Aarts, & Ruys, 2010). Such an unconscious authorship ascription process may explain why we can experience self-causation over the goals and outcomes we obtain (such as causing emotions in other persons), even though we are unaware of the goal causing the pursuit and outcomes.

In a recent demonstration of this idea, Aarts et al. (2009) instructed their participants to stop a rapidly presented sequence of colors on a computer screen by pressing a key. After stopping the color sequence, they were presented with an "outcome" color that could be the color on which they had stopped the sequence or a color that was randomly presented by the computer. Thus, the task was designed in such a way that either the participant or the computer could be the cause of the presented color, rendering the exclusivity of the cause of outcomes ambiguous (Wegner & Wheatley, 1999). After the presentation of the outcome color, participants indicated the extent to which they felt to have caused the color sequence to stop on the outcome color. The results showed that subliminally priming a particular color (e.g., *red*) just before that color appeared as the outcome color increased experienced self-agency over producing the outcome color relative to priming no color. Interestingly, subliminally priming a different color (e.g., *blue*) before observing the outcome color (e.g., *red*) did not decrease experienced self-agency over producing the outcome color relative to priming no color. These and other findings suggest that the experience of self-agency over behavior relies on an exact match between unconsciously preactivated and observed outcomes.

Crucially, emotional expressions emerging in social interactions differ in two important respects from mere action outcomes that research on authorship ascription has previously studied. First, whereas previous research on self-agency experience over ambiguous action outcomes typically focused on outcomes that are closely linked in time and space to a single, physical action (e.g., movement of the finger to switch on the light), emotional expressions that occur in social interactions (e.g., a smile elicited by a friendly gesture) are inevitably action outcomes that are more remote. In social interactions, the action outcome, by definition, involves the behavior of another agent, irrespective of whom or what has caused the action outcome to occur. Moreover, emotional expressions that occur in social interactions are not necessarily linked to one particular action. One's interaction partner may, for

example, react with a smile to a set of behaviors, rather than one single movement.

Second, whereas previous research involved trivial outcomes with no particular positive or negative valence (e.g., a color, a particular location in a grid of squares, a line being drawn on a screen), emotional expressions in social interactions are socially meaningful action outcomes that are typically considered positive or negative (Ruys & Stapel, 2008b). Besides the communicative function of emotional expressions directly relevant for social interactions (Ekman, 1992; Fridlund, 1994; Izard, 1994; Jakobs, Fischer, & Manstead, 1997; Keltner & Haidt, 1999; Ruys & Stapel, 2008b), emotional expressions derive their meaning from associations with various kinds of information that are stored in memory. Exposure to emotional expressions may, through associative priming (Neely, 1977) for example, activate situations or actions that typically elicit the associated emotion (e.g., a nasty remark eliciting anger), typical consequences of the emotional expressions (e.g., observers of angry expressions may feel threatened), or autobiographical memories of experiencing the associated emotion oneself (e.g., the occasion where one reacted aggressively to a pushy beggar on the street). In addition, emotional expressions that occur in social interactions are naturally associated with positivity or negativity: A smile is generally associated with positive affect and a frown with negative affect (Murphy & Zajonc, 1993; Ruys & Stapel, 2008b; Stapel, Koomen, & Ruys, 2002). Consequently, (unconscious) exposure to emotional expressions may also activate valence congruent information in memory through affective priming (e.g., Fazio, 2001; Hermans, De Houwer, & Eelen, 1994; Klauer, 1997; Ruys, Dijksterhuis, & Corneille, 2008).

So, in contrast to neutral, trivial action outcomes that were previously examined in research on the ascription of personal authorship, socially meaningful information may, upon exposure, automatically activate both conceptually associated information and information of the same positive or negative valence. This raises the question whether the inference process typically observed in research on priming and agency experiences also underlies authorship ascription processes in social interactions. We suggest that the process of self-agency over causing emotions in others during social interactions may operate at a more general level that does not take the exact nature of unconsciously primed knowledge into account. That is because emotional expressions occurring in social interactions are action outcomes that are remote and have a strong positive or negative valence independent from the context in which they appear.

Assuming that experiences of self-agency in social interactions rely on an inference process that matches observed action outcomes and prior knowledge about an action outcome, an important consequence of the activation of associated information through associative and affective priming, we propose, is that the unconscious authorship ascription process is less specific and rigid. Specifically, we propose that people's experienced self-agency over another agent's emotional expression may also be influenced by prior activation of knowledge that is not entirely identical but merely associated with the observed emotional expression in terms of the actions that typically produce this emotional expression or its positive or negative valence. For example, (unconscious) activation of the action concept *shouting* prior to observing a fearful expression in another agent may increase the sense of self-agency

over causing the emotional expression. Similarly, exposure to a *sad* expression may increase experienced self-agency over causing another agent's disgusted expression. More generally put, we hypothesize that experienced self-agency over an observed action outcome may increase when the information that was activated shortly before is linked with the observed outcome in terms of associated actions or valence. Such a more lenient unconscious authorship ascription process fits well with the human tendency to heavily rely on associated knowledge and valence in understanding behaviors of agents (Ruys, Dijksterhuis, & Corneille, 2008; Ruys, Spears, & Gordijn, 2008; Ruys, Spears, Gordijn, & de Vries, 2006, 2007; Stapel et al., 2002).

### The Present Research

To find empirical support for our hypotheses on authorship ascription processes over the emotions of other agents that emerge in social interactions, we conducted four experiments. In these experiments, we asked participants to interact with a (computerized) agent and told them that their actions could elicit facial emotional expressions in this agent. Specifically, participants were instructed to tap the keys on the keyboard while varying the rhythm and the order of tapping the keys. This tapping behavior could elicit different kinds of emotions in the other agent, for example a happy, sad, or angry facial expression. Simulating the dynamics of everyday face-to-face interaction, in each trial participants observed a neutral facial expression of the other agent during their tapping, and this neutral expression suddenly changed into an emotional expression. Crucially, participants learned that the emotional expression of the other agent could have been caused by their tapping, but that the other agent could also display an emotional expression randomly. Thus, it would be unclear what had caused the emotional expression of the agent. Directly after the agent displayed her emotional expression on the screen, participants were asked to indicate the extent to which they felt they had caused the emotional expression of the agent (see, for a conceptually similar setup, Aarts et al., 2009; Van der Weiden et al., 2010).

Using this "action-expression" paradigm, we first explored whether experienced self-agency over another agent's emotional expressions indeed relies on an inference process that matches actually observed and previously activated action outcomes. To this end, we aimed to establish in Experiment 1a that having prior knowledge about the observed emotional expression increases experienced self-agency over this emotional expression when it is actually observed in another agent. Further, to demonstrate the general nature of the unconscious authorship ascription process over causing emotions in others, we examined priming effects on experienced self-agency over the six basic emotions: happy, sad, anger, disgust, fear, and surprise (e.g., Ekman, 1992; Izard, 1992; Panksepp, 1992; Plutchik, 1994). Accordingly, in Experiment 1a, we either subliminally primed participants with a neutral facial expression or with the observed emotional expression (i.e., the expression that actually emerged in the agent after tapping the keyboard in a particular rhythm and configuration).

In Experiment 1b we aimed to rule out that it is not just the priming of any emotion that enhances self-agency experiences over another agent's emotional expression, but that the effect pertains to the specific emotion and positive or negative valence

involved (e.g., priming with sad increases self-agency over sad expressions, but not over happy expressions). In Experiment 1b, we subliminally primed participants with a neutral facial expression, with the observed emotional expression (emotion congruent, i.e., sad-sad), or with an emotional expression that did not correspond with the observed emotional expression in terms of meaning and valence (emotion incongruent, i.e., happy-sad). In line with previous research (e.g., Aarts et al., 2009), we expected that experienced self-agency over a particular emotional expression of another agent would increase after priming with the same emotional expression prior to performing actions that can elicit emotions and observing the emotional expression, compared to priming with neutral expressions and priming with emotion incongruent expressions.

In Experiment 2, we examined whether prior information associatively linked with an observed emotional expression may also increase experienced self-agency over the observed emotional expression of another agent. More specifically, we investigated whether prior, unconscious activation of action concepts that typically elicit a particular emotion (e.g., *reward*, *shout*, *hit*) and therefore are strongly associated with the emotional expression, increases experienced self-agency over that emotional expression of another agent (e.g., *a happy, angry, or fearful expression*) when this expression is observed. We reasoned that the activation of actions that typically elicit a particular emotion would prime the emotion and emotional expression through associative spreading of activation. We therefore predicted that compared to subliminal priming of neutral actions, subliminal priming of emotion-eliciting actions would, increase experienced self-agency over the associated emotional expression.

In Experiment 3, we took our research yet another step further and investigated to what extent the activation of an emotional expression of the same negative valence as the observed emotional expression influenced experienced self-agency over the observed emotional expression of another agent. To examine this question, we subliminally primed participants with the observed emotional expression (emotion congruent, i.e., sad-sad), with an emotional expression that corresponded the observed emotional expression in terms of its negative valence (valence congruent, i.e., disgusted-sad), or with a neutral expression (i.e., neutral-sad). Based on our idea that the (unconscious) activation of emotional expressions may activate emotional expressions of the same positive or negative valence through affective priming, we expected that compared to priming with neutral expressions, priming with emotional expressions of the same negative valence would increase experienced self-agency over the observed emotional expression of the agent.

## Experiment 1a

### Method

**Overview.** Participants interacted with a (computerized) agent and performed actions that could produce various facial emotional expressions in this agent. They could interact with the agent by tapping the keys of the keyboard in various rhythms and orders. After performing a series of actions, the neutral expression of the agent turned into a happy, sad, disgusted, fearful, surprised, or angry facial expression. Participants were told that the observed emotional expression of the agent could be the result of their

tapping, or that the agent displayed an emotional expression randomly. Thus, it would be unclear whether the participant had caused the emotion in the agent, or the agent randomly displayed the emotional expression. In reality however, the computer always determined the emotional expression.

During each interaction with the agent, a neutral facial expression repeatedly appeared in the center of the computer screen in response to participants' tapping of the keys. After some period of tapping, the neutral expression turned into an emotional expression. Immediately after this emotional expression of the agent, participants indicated to what extent they felt they had caused this emotional expression.

The neutral expression was presented repeatedly in order to draw participants' attention to the screen (and to the face of the computerized agent) and to mask the subliminal primes that appeared in between. As explained, we expected that priming the observed emotional expression prior to executing actions that can elicit an emotion, and actually observing the emotional expression, increases experienced self-agency over the observed emotional expression, compared to priming a neutral expression.

**Participants and design.** Ninety-nine undergraduates participated for course credits or a small fee. Within participants, we varied the observed emotional expression of the agent (happy, sad, disgusted, surprised, fearful, angry) and the primed expression (congruent, neutral). Each emotional expression was 12 times observed as outcome: 6 times subliminally primed with congruent expressions and 6 times subliminally primed with neutral expressions. This resulted in 72 trials that were presented in a random order.

**Procedure and materials.** Participants worked in separate cubicles on the task. They were told that the study was designed to examine people's experiences of agency and how these experiences come and go. For this purpose, they performed a task in which their action might cause an outcome that could also be determined by a computerized agent. Specifically, they were told that the task was designed to simulate everyday social interactions in which one's own actions could cause emotions in another person. Accordingly, participants had to perform specific actions that could elicit different kinds of emotions in the computerized agent.

The "action-expression task" consisted of a series of trials. On each trial, the same sequence of events occurred (see also Figure 1): First, the instruction to press ENTER and start tapping the keys of the bottom letter row of the keyboard (Z, X, C, V, B, N, M) appeared. After pressing the ENTER key, each tap on a key of the bottom letter row was followed by the presentation of a neutral facial expression for 250 ms. After 13 taps, the last four taps were followed by a priming sequence that consisted of a neutral facial expression presented for 125 ms, a prime presented for 30 ms, and a neutral facial expression presented for 125 ms. Thus, on each trial the prime appeared four times. After the final tap and priming sequence, an empty screen briefly appeared for 500 ms, followed by an emotional expression that was presented for 500 ms. To summarize, on each trial the neutral expression of the agent appeared on the screen several times and finally turned into an emotional expression. Then, participants indicated on a 9-point scale to what extent they felt they had elicited the observed emotional expression of the agent [from 1 (*not at all me*) to 9 (*absolutely me*)].

We selected the neutral, happy, sad, surprised, disgusted, fearful, and angry expression of *Female 4* from the pretested Facial Emotional Expression Database of Roy and colleagues (2007) to indicate the emotional expression of the agent. The neutral and emotional expressions were static black-and-white images. Hair and clothing were cropped from these facial expressions, such that each image consisted of nothing but the face. The size of each image was  $256 \times 256$  pixels, resulting in a size of  $9 \times 9$  cm on the computer screen.

**Debriefing.** To assess participants' awareness of the primes, we employed a funneled debriefing procedure after all trials were completed. Results showed that none of the participants reported having seen emotional expressions, except for the observed emotional expression of the agent at the end of each interaction. Further, none of the participants realized the true nature of the study.

## Results

We subjected the self-agency ratings to a  $6$  (Observed expression: happy, sad, disgusted, surprised, fearful, angry)  $\times$   $2$  (Primed

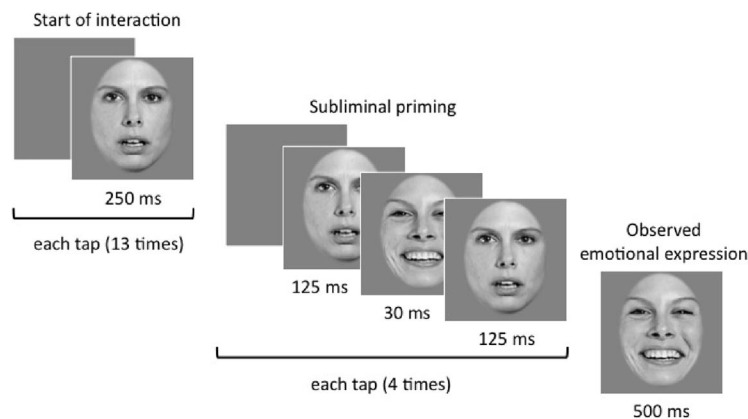


Figure 1. Sequence of events occurring on an interaction trial in response to participants' tapping of the keyboard keys.



expression: congruent, neutral) repeated-measures analysis of variance (ANOVA). As expected, a main effect of primed expression occurred,  $F(1, 98) = 7.98, p < .006, \eta_p^2 = .08$ , and no interaction. Self-agency ratings were higher after priming congruent expressions ( $M = 4.17, SD = 1.66$ ) than after priming with neutral expressions ( $M = 3.86, SD = 1.67$ ). To illustrate this priming effect for all six emotions, we present the mean self-agency ratings as a function of observed expression and primed expression in Table 1.

## Experiment 1b

### Method

In this experiment, the neutral expression of the agent changed into a *happy* or *sad* expression after an interaction. During an interaction, participants were subliminally primed with emotion congruent, emotion incongruent, or neutral facial expressions. We expected an increase in experienced self-agency over an observed emotional expression of the agent after priming emotion congruent expressions, and no decrease in experienced self-agency over an observed emotional expression of the agent after priming emotion incongruent expressions, compared to priming neutral expressions.

**Participants and design.** Sixty-nine undergraduates participated for course credits or a small fee. Within participants, we varied the observed expression of the agent (happy, sad) and the primed expression that preceded the observed expression of the agent (emotion congruent, emotion incongruent, neutral). Each emotional expression was 18 times observed as outcome: 6 times subliminally primed with congruent expressions, 6 times subliminally primed with incongruent expressions, and 6 times subliminally primed with neutral expressions. This resulted in 36 trials that were presented in a random order.

**Procedure and materials.** The “action-expression” task was identical to Experiment 1a. As in the first experiment, an awareness check showed that none of the participants reported to have seen the primed emotional expressions during their tapping behavior. Further, none of them realized the true nature of the study.

### Results and Discussion

We subjected the self-agency ratings to a 2 (observed expression: happy, sad)  $\times$  3 (primed expression: congruent, incongruent,

Table 1  
*Mean (SD) Self-Agency Ratings as a Function of Observed Expression (Happy, Sad, Disgusted, Surprised, Fearful, Angry) and Primed Expression (Emotion Congruent Expression, Neutral Expression)*

Primed expression	Congruent	Neutral
Observed expression		
Happy	4.41 (1.90)	4.24 (1.97)
Sad	4.16 (1.82)	3.71 (1.86)
Disgusted	4.06 (1.75)	3.70 (1.78)
Surprised	3.91 (1.73)	3.55 (1.71)
Fearful	4.28 (1.92)	3.87 (1.84)
Angry	4.20 (1.80)	4.06 (1.94)

*Note.* Scale range on the self-agency ratings is from 1 to 9. Higher means indicate a higher level of experienced self-agency over the observed emotional expression of the agent.

neutral) repeated-measures ANOVA. Similar to Experiment 1a, the analysis yielded a main effect of primed expression,  $F(2, 136) = 5.25, p < .006, \eta_p^2 = .08$ , and no interaction.

Planned contrast analyses showed that self-agency ratings increased after priming with congruent expressions ( $M = 3.99, SD = 1.71$ ), compared to priming with incongruent expressions ( $M = 3.64, SD = 1.54$ ),  $F(1, 68) = 6.40, p < .006, \eta_p^2 = .09$ , and compared to priming with neutral expressions ( $M = 3.59, SD = 1.56$ ),  $F(1, 68) = 9.23, p < .003, \eta_p^2 = .12$ . Self-agency ratings after priming with incongruent expressions and after priming with neutral expressions did not differ,  $F < 1$ .

The results of Experiment 1a and 1b demonstrate that the (unconscious) activation of a particular emotional expression may (in case that particular emotional expression is indeed observed) increase one’s experience of being the cause of that emotional expression of another agent. Experiment 1a showed this priming effect on experienced self-agency over an emotional expression of another agent for the six basic facial emotional expressions (i.e., happy, sad, anger, disgust, fear, surprise), revealing the general nature of authorship processing when it comes to the causation of emotions of other people. The results of Experiment 1b also demonstrate that the unconscious activation of a particular emotional expression that does not match the observed emotional expression, in terms of both meaning and valence, does not decrease or increase one’s experience of being the cause of the observed emotional expression. Experienced self-agency over a particular emotional expression of another agent only increased after priming the *same* emotional expression prior to performing actions and observing the expression, compared to priming neutral or emotion incongruent expressions. In other words, experienced self-agency over another agent’s emotional expression only increased after subliminal priming of an emotional expression with the same meaning and valence as the observed emotional expression, and not after subliminal priming of just any emotional expression (cf. Aarts et al., 2009, for similar effects concerning color priming and self-agency experiences).

Both experiments confirm and extend earlier research on the ascription of personal authorship to remote and meaningful action outcomes with a positive or negative valence and, more generally, to authorship ascription processes occurring in social interactions. Having established this initial but crucial step, we now turn to investigate the specificity of the inference process that takes into account previously activated information about action outcomes and actually observed action outcomes, and serves as input for experienced self-agency over another agent’s emotional expressions.

## Experiment 2

### Method

In Experiment 2, we examined whether previous activation of information associatively linked with an observed emotional expression may also increase experienced self-agency over the observed emotional expression in another agent. Specifically, we investigated whether the activation of emotion-eliciting action concepts (e.g., *reward, please, kiss*) prior to executing actions that can produce emotions and observing an associated emotional expression in another agent (e.g., a happy facial expression) in-

creased experienced self-agency over that emotional expression. To this end, participants again interacted with a (computerized) agent and performed actions that could result in various facial emotional expressions in this agent. While interacting with the agent, participants were subliminally primed with actions that typically elicit specific emotional reactions in the target of these actions. Our hypothesis was that the (unconscious) activation of an action that typically elicits a specific emotion in the target of that action would subsequently activate the associated emotional expression in memory through associative priming and, therefore, increase experienced self-agency over that emotional expression.

**Participants and design.** Ninety-two undergraduates participated for course credits or a small fee. Within participants, we varied the observed emotional expression of the agent (happy, angry) and the compatibility of the primed action with the emotional expression (emotion compatible, neutral). Each emotional expression was 20 times observed as outcome: 10 times subliminally primed with compatible actions and 10 times subliminally primed with neutral actions.

This resulted in 40 trials that were presented in a random order.

**Procedure and materials.** Participants performed the “action-expression” task and were instructed to interact with another agent by tapping the keys on the keyboard. However, this time, participants were specifically instructed that the designated keys represented actions that could elicit happiness or anger. Tapping a key could for example represent the action *reward* or *punish*, which could elicit happiness or anger, respectively. To participants, it was explained that the relation between certain keys and actions varied throughout the experiment and thus was not fixed. Thus, in actuality there was no relation between participants’ tapping behavior and action concepts associated with happiness or anger. After performing a series of “actions,” the neutral expression of the agent that repeatedly appeared on the screen would turn into an emotional expression.

To enable subliminal priming of action words while interacting with the other agent, we adjusted the sequence of events in a trial (see, for a similar subliminal priming procedure, Aarts et al., 2009; Van der Weiden et al., 2010): First, the instruction to press ENTER and start tapping the keys of the bottom letter row of the keyboard (Z, X, C, V, B, N, M) appeared. After pressing the ENTER key, each tap on a key of the bottom letter row was followed by the presentation of two random letter strings (e.g., OSYMWKJER) that were each presented for 125 ms and a neutral facial expression presented for 250 ms. After 12 taps, the next four taps were followed by a priming sequence that consisted of a random letter string serving as forward mask (100 ms), an action word serving as prime (30 ms), a random letter string serving as backward mask (100 ms), and a neutral facial expression (250 ms). The final tap was followed by a priming sequence consisting of a random letter string (100 ms), an action word (30 ms), two random letter strings (each 100 ms), an action word (30 ms), a random letter string (100 ms), and finally, the observed emotional expression (500 ms). Thus, on each trial the prime appeared six times. In sum, similar to the previous experiments, on each trial the neutral expression of the agent appeared on the screen several times (interrupted by random letter strings) and finally, turned into an emotional expression. After the emotional expression of the agent had appeared, participants indicated on a 9-point scale to what extent they felt they had elicited this emotional expression.

The observed happy and angry emotional expressions of the agent were the same as in Experiment 1a. As primes, we selected five actions that typically elicit anger (*beat, punish, offend, lie, harass*), five actions that typically elicit happiness (*reward, treat, kiss, please, congratulate*), and five neutral actions (*walk, write, dry, explain, learn*).

**Debriefing.** An awareness check showed that none of the participants reported to have seen action words during the tapping task. Further, none of them realized the true nature of the study. Two participants responded exceptionally fast (within 100 ms) to the self-agency rating question, suggesting that they did not take the task seriously. These two participants were omitted from the analyses.

## Results and Discussion

We subjected the self-agency ratings to a 2 (observed expression: happy, angry)  $\times$  2 (primed action: emotion compatible, neutral) repeated-measures ANOVA. Expectedly, the analysis only revealed a main effect of primed action,  $F(1, 89) = 4.63, p < .03, \eta_p^2 = .05$ , showing that self-agency ratings increased after priming with actions that are associatively linked with the emotional expression of the agent ( $M = 3.26, SD = 1.67$ ), compared to priming with neutral actions ( $M = 3.12, SD = 1.63$ ).

The results show that subliminal priming of actions that typically elicit specific emotions increased experienced self-agency over associated emotional expressions, relative to subliminal priming of neutral actions. More generally, our results demonstrate that prior unconscious activation of behavioral information (e.g., *offend*) associatively linked with an observed action outcome (e.g., *anger*) indeed increases experienced self-agency over the observed outcome. To provide further evidence for our hypothesis that prior, unconscious activation of action outcomes that are associatively related and/or share the same positive or negative valence with the actually observed action outcome increases experienced self-agency over the observed action outcome, we conducted Experiment 3. Here, we investigated whether the unconscious activation of emotional expressions primarily linked in terms of their negative valence with the observed emotional expression also increase experienced self-agency over the observed emotional expression in another agent.

## Experiment 3

We investigated the hypothesis that prior activation of emotional expressions with the same, positive or negative valence as the observed emotional expression increases experienced self-agency over the observed emotional expression in another agent. Specifically, we investigated whether subliminal priming of an emotional expression (e.g., sadness) prior to executing actions that can result in emotions and observing an emotional expression of the same valence (e.g., anger) increased experienced self-agency over the observed emotional expression, relative to priming a neutral expression. Based on the idea that unconscious activation of emotional expressions also activates associated emotional expressions through affective and associative priming, we expected subliminal priming of emotional expressions of the same, negative valence as the observed emotional expression to increase experi-

enced self-agency over the observed emotional expression of the agent.

## Method

**Participants and design.** Ninety-nine undergraduates participated for course credits or a small fee. Within participants, we varied the observed expression (sad, disgusted, fearful) and the primed expression (sad, disgusted, fearful, neutral). Each emotional expression was 24 times observed as outcome: 6 times subliminally primed with emotion congruent expressions, 12 times subliminally primed with valence congruent expressions, and 6 times subliminally primed with neutral expressions. This resulted in 72 trials that were presented in a random order.

**Procedure and materials.** The “action-expression” task was identical to Experiment 1a and 1b, except that the neutral expression of the agent changed into three types of emotional expressions, namely sad, disgusted, and fearful expressions.

## Results and Discussion

We subjected the self-agency ratings to a 3 (observed expression: disgusted, sad, fearful)  $\times$  3 (primed expression: emotion congruent, valence congruent, neutral) repeated-measures ANOVA. As expected, a main effect of primed expression occurred,  $F(2, 196) = 10.60$ ,  $p < .001$ ,  $\eta_p^2 = .10$ , and no interaction.

Planned contrast analyses revealed that, compared to priming with neutral expressions ( $M = 3.46$ ,  $SD = 1.63$ ), self-agency ratings not only increased after priming with emotion congruent expressions ( $M = 3.91$ ,  $SD = 1.73$ ),  $F(1, 98) = 14.02$ ,  $p < .001$ ,  $\eta_p^2 = .13$ , but also after priming with valence congruent expressions ( $M = 3.80$ ,  $SD = 1.63$ ),  $F(1, 98) = 9.43$ ,  $p < .003$ ,  $\eta_p^2 = .09$ . Self-agency ratings after priming with emotion congruent expressions and after priming with valence congruent expressions did not differ significantly,  $F(1, 98) = 2.72$ ,  $p < .10$ .

The results replicate the findings of Experiment 1a and 1b, showing that the (unconscious) activation of a particular emotional expression (relative to a neutral expression) increases experienced self-agency over an emotional expression when that particular emotional expression is actually observed in another agent. More important, the results show that unconscious activation of an emotional expression with the same, negative valence as the emotional expression observed also increases experienced self-agency over the emotional expression. Our results suggest that unconsciously activated emotional expressions may prime other emotional expressions of the same valence. Subsequently, these other emotional expressions of the same valence may lead to the inference that a match occurred between prior knowledge about an emotional expression and the actually observed emotional expression of another agent.

In this experiment, we investigated whether subliminal priming of specific emotional expressions of fear, sadness, or disgust would influence experienced self-agency over observed emotional expressions of fear, sadness, and disgust. We selected these three emotional expressions because they are of the same negative valence, but differ in terms of the specific cognitions, feelings, and behaviors that they are associated with. This was to demonstrate our main point: That a prior activation of emotional expressions with the same valence as the observed emotional expression in-

creases experienced self-agency over the observed emotional expression. However, one could argue that we should have included specific positive emotions to make our case. Yet, positive emotions, such as joy and happiness, are not only less specific and inherently more valence-based (Fredrickson, 2001), but they are also not clearly associated with a distinctive facial expression, giving us insufficient opportunity to test the effects of valence when the specific emotional meaning is incongruent. Therefore, no positive emotions were included in the present experiment.

## General Discussion

“Is she smiling because of my silly remark, because I have something between my teeth, or because her favorite colleague just entered the room?” The experience that we have a sense of being the cause of someone else’s emotions, but do not know exactly why, is a familiar experience to most people. The present research examined how such a conscious experience of self-agency over others’ emotions may result from unconscious sources.

Our initial aim was to demonstrate that people’s sense of being the cause of another agent’s emotion may, similar to experienced self-agency over more trivial action outcomes, depend on an inference process that matches observed action outcomes and knowledge about an outcome that was activated just prior to observing the outcome. All four experiments confirmed this idea, and showed that subliminal priming of an observed emotional expression prior to executing actions that can elicit emotions and observing the emotional expression in another agent increased experienced self-agency over the emotional expression of the agent.

Importantly, we also demonstrated, in contrast with previous authorship ascription research suggesting that self-agency experiences over trivial action outcomes result from an exact match between an outcome and preactivated knowledge (Aarts, 2007; Aarts et al., 2005, 2009; Belayachi & van der Linden, 2009; Sato, 2009; Sato & Yasuda, 2005; Van der Weiden et al., 2010), that the process of self-agency over causing emotions in others during social interactions may operate at a more general level that does not take the exact nature of unconsciously primed knowledge into account. Taking into account the relevance of one’s own actions and other affective cues for understanding the behaviors of others, we reasoned that the inference process that serves as input for the experience of personal authorship not only occurs when there is a strict match between the outcome of an action and knowledge that was made active just prior to its occurrence, but may also occur when previously activated knowledge primes the outcome of an action through associative spreading of activation. The results of Experiments 2 and 3 support this notion, showing that the unconscious activation of associated action concepts or emotional expressions of the same valence prior to executing actions and observing an emotional expression in the agent increased the extent to which participants experienced to be the cause of the observed emotional expression. Thus, when observing another agent’s smile, cry, or frown, one may infer that one has caused this emotional expression to emerge when information associatively or affectively linked with the observed emotion was activated shortly prior to observing the emotion, even when the emotion was actually caused by an external source.



The present research thus showed, by focusing on the conceptual and affective associations of preactivated knowledge, that personal authorship ascription over socially meaningful action outcomes relies on a less rigid inference process. Such a more general inference process implies that the action-related and affective associations that are automatically activated before observing an agent's ambiguous behavior can also enter the authorship ascription process. For example, when our interaction partner starts to shout, experienced self-agency over this shouting behavior may be amplified when, prior to uttering a sentence and observing the shouting, the emotion anger was unconsciously activated. In line with recent priming research on emotions and social perception (Aviezer et al., 2008; Innes-Ker & Niedenthal, 2002; Higgins, Rholes, & Jones, 1977; Stapel & Koomen, 2000), the (unconscious) activation of anger automatically leads us to perceive the shouting of our interaction partner as a sign of being angry, and this perception subsequently produces a match between the observed outcome (e.g., shouting) and the information that was unconsciously preactivated (e.g., *anger*). In other words, action concepts do not only prime emotions and experienced self-agency over these emotions in others. Emotions also bias perceptions of another agent's behavior in line with the primed emotions, and as such promote a sense of self-agency over other's behavior. Importantly, if emotion priming effects on the perception of another agent's behavior indeed augment experienced self-agency, this would provide additional support for the suggested more general authorship ascription process in social interactions. Intriguingly, such a finding would also imply that people may not only experience to be the cause of rather impulsive, reactive behaviors of other agents such as facial emotional expressions, but even of others' more goal-directed, willful behaviors such as shouting.

It is important to note that the present experiments were designed in such a way that experienced self-agency over causing the emotion of another agent was illusory. In all four experiments, participants were not the true cause of the agent's emotional expression because the computer always determined the expression that was displayed. This illusion of self-causation over behavior is informative, as it demonstrates that our experience of control does not always correspond with actual control over one's own behavior (e.g., Dijksterhuis & Aarts, in press), and this should not be different in the context of social interactions.

However, we wish to stress that considering ourselves as the cause of our own actions and the resulting outcomes is not necessarily illusory. As research on behavior priming shows (e.g., Aarts & Dijksterhuis, 2003; Holland, Hendriks, & Aarts, 2005; Wheeler, DeMarree, & Petty, 2007), activating behavior representations (such as shouting) outside of awareness is also more likely to trigger the corresponding behavior than when this representation is not activated. One's primed behavior may cause the interaction partner to react emotionally (e.g., by getting angry), even without conscious awareness of what caused this reaction to emerge. Hence, self-agency and unconscious activation of emotionally relevant information in social interactions may go hand in hand as the activated emotionally relevant information promotes both changes in emotional expressions of interaction partners as well as agency experiences. As a result, agency experiences in such situations may not be deceptive, but rather an accurate assessment of the source that produced the emotions in others. Thus, whereas the experience of self-agency can be a guess, sometimes this guess is

right. Although these experiences could be seen as a "by-product" of our automatic and unconscious behaviors (e.g., Wegner, 2002), they may serve us well because they can help us to identify the results of our actions in social situations when we lack conscious knowledge of producing them.

Based on the idea that emotionally relevant information automatically primes behavior, an interesting issue to explore in future research is the role of (unconscious) facial mimicry in self-agency experiences over the emotional reactions of another agent. Facial mimicry can occur automatically, often without conscious awareness of both the mimicker and the person being mimicked (Chartrand & Bargh, 1999), and is said to function as a social glue (Lakin, Jefferis, Cheng, & Chartrand, 2003). Although speculative, an interesting possibility is that facial mimicry of emotional expressions (i.e., emotional contagion, Dimberg, Thunberg, & Elmehed, 2000; Hatfield, Cacioppo, & Rapson, 1992) increases experienced self-agency over another agent's emotional reaction. Specifically, the activation of the motor representation of the emotional expression due to facial mimicry may serve as input for the inference process that determines experienced self-agency over the emotional expression of the other agent. If our conception of the inference process underlying experienced self-agency is indeed correct, this would imply that people who are more likely to mimic their interaction partners are more likely to experience self-agency over the emotions of others, even when these emotions have a different cause.

More generally, the present approach of studying emotions in social interactions fits well with other recent attempts to study agents in a social context rather than in isolation (Becchio, Sartori, & Castiello, 2010; Lakens & Ruys, 2010; Sebanz, Bekkering, & Knöblich, 2006; Ruys & Aarts, 2010; Wolpert, Doya, & Kawato, 2003). Similar to our current findings, these attempts emphasize the importance of social psychological factors in basic action-related phenomena. Crucially, however, the present findings also give substance to the intuitively strong connection between action and emotion, and increase our understanding of how observing emotions in others may instigate social learning. Emotional expressions of others may facilitate learning as they can serve as feedback on our own behavior (Ekman, 2003). Whereas happy facial expressions communicate a positive evaluation of our behavior (Matthews & Wells, 1999), angry or disgusted facial expressions communicate that we should modify our current behavior (Blair, 1995). We suggest that the more observers experience to be the cause of their interaction partner's emotional expressions, the more they interpret emotional expressions of their interaction partner as feedback on their current behavior. For example, when having the experience of being the cause of another agent's joy, one is likely to continue one's behavior with similar actions. However, when having the experience of causing anger in another agent, one is likely to adjust one's behavior in appropriate ways. Thus, observing others' facial emotional expressions may determine subsequent behavior depending on the extent of experienced self-agency over our interaction partner's facial emotional expressions. Intriguingly, the fact that personal authorship ascription relies on an inference process offers the possibility that experienced self-agency even enables observers to adjust their behavior in cases where they were not consciously aware of the behavior that they performed.



In sum, the present research shows how a conscious experience of self-agency over others' emotions may result from unconscious sources. Highlighting the importance of the nature of one's own actions and affective information for understanding the behaviors of others, we showed that the inference process underlying experienced self-agency over causing emotions in others operates at a more general level that does not take the exact nature of unconsciously primed knowledge into account. This research nicely illustrates the nontrivial fact that emotions lie at the heart of effective social interactions.

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