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Imagination inflation in the mirror: Can imagining others' actions induce false memories of self-performance?

Isabel Lindner [a,*], Gerald Echterhoff [b]

[a] Department of Psychology, University of Kassel, Holländische Str. 36-38, 34127 Kassel, Germany
[b] Department of Psychology, University of Münster, Fliednerstr. 21, 48149 Münster, Germany

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ABSTRACT

Imagining oneself performing a simple action can trigger false memories of self-performance, a phenomenon called imagination inflation. However, people can, and often do, imagine others' behavior and actions. According to a visual-similarity account, imagining another person's actions should induce the same kind of memory error, a false memory of self-performance. We tested this account in three experiments, in which performance was followed by imagination. In the imagination phase, participants were asked to either imagine themselves or to imagine another person performing actions, some of which were not previously performed. Two weeks later, a surprise source-memory test was administered in which participants had to decide whether a depicted action had been performed or not performed. Results revealed that imagining another person can trigger false memories of self-performance. However, visual similarity between performance and imagination predicted the amount of false memories only for other-imagination but not for self-imagination. These findings are consistent with research suggesting that other- and self-imagination rely on different mechanisms: While other-imagination primarily involves visual imagery, self-imagination primarily involves motor imagery. Accordingly, false action memories from other-imagination may result from visual similarity, whereas false action memories from self-imagination may result from motor simulation.

1. Introduction

Did you lock the door this morning? Research has shown that imagining yourself locking the door can later make you believe that you have actually locked it when in fact you have not. Such a false memory consisting in the misattribution of merely imagined actions as performed was dubbed the *imagination–inflation effect* (Goff & Roediger, 1998, see also Garry, Manning, Loftus, & Sherman, 1996). In this type of false action memory, the *modality* in which an action was originally encoded (performance vs. imagination) is confused in hindsight. However, humans' imaginative capacities allow them not just to imagine their own, but also other people's behaviors (e.g., Decety & Grèzes, 2006). According to a widely held view, imagination inflation stems from the sensory similarity between imagined and performed acts (e.g., Thomas, Bulevich, & Loftus, 2003). Thus, imagining *another person* performing a simple action, for example locking the door, should lead to the same kind of memory error, a false memory of actually having locked the door oneself. Hence, people may confuse not only the modality but also the *agent* of actions (self vs. other). In the present studies, we thus investigated whether the imagination of *another person's acts* can produce false memories of *self-performance*.

In the common paradigm for studying false action memories from self-imagination (Goff & Roediger, 1998), participants perform or do not perform simple actions in a first phase (e.g., *Unlock the lock*), and, in a second phase, imagine or do not imagine themselves performing some of these actions. In this second phase, some of the to-be-remembered actions are usually presented once and others are presented repeatedly. In a later surprise source-memory test, it is typically found that imagination, especially when repeated, leads to a significant proportion of false action memories. That is, participants remember having performed actions when in fact they have not performed these actions in Phase 1, but only imagined themselves performing these actions in Phase 2. This (self-)imagination–inflation effect is robustly found (e.g., Lampinen, Odegard, & Bullington, 2003; Seamon, Philbin, & Harrison, 2006; Thomas & Loftus, 2002).

False memories from self-imagination have often been explained by source-monitoring difficulties resulting from the perceptual similarity of imagination and performance (e.g., Lampinen et al., 2003; Thomas et al., 2003). By this account, participants monitor information reactivated during a memory test for cues diagnostic for actual performance (Johnson & Raye, 1981; Johnson, Hashtroudi, & Lindsay, 1993). Because both modalities, performance and imagination, involve the encoding of sensory features, people sometimes have difficulties in

* Corresponding author. Tel.: +49 561 804 3585; fax: +49 561 804 3584.
E-mail addresses: isabel.lindner@uni-kassel.de (I. Lindner), g.echterhoff@uni-muenster.de (G. Echterhoff).

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deciding whether a vivid sensory memory trace was previously perceived during self-performance or merely imagined. Given the dominance of vision among the human senses (e.g., Posner, Nissen, & Klein, 1976) and its outstanding role in the attribution of agency (e.g., Jeannerod & Pacherie, 2004), it is reasonable to assume that among the sensory impressions generated through imagination visual features are critical in eliciting false action memories (see also Lindner & Henkel, in press). By this view, imagination inflation is primarily due to the similarity of visual representations generated through performance and imagination. Consistent with this notion, research has shown that memory traces from imagination are predominantly visual in nature (e.g., Johnson, Foley, Suengas, & Raye, 1988).

Imagination can be conceptualized as a mental simulation of an action or event (e.g., Denis & Kosslyn, 1999; Shepard & Cooper, 1986) aimed at either reliving past or anticipating future events (e.g., Schacter & Addis, 2007; Suddendorf & Corballis, 2007). For instance, an applicant could mentally simulate an upcoming job interview. These simulations are not restricted to the self, but can also include other people (e.g., Decety & Grèzes, 2006). In the example, the applicant may not only imagine her or his own behaviors, but also the interviewer's behaviors, from welcoming the applicant to closing the door behind him or her.

These considerations beg the question of whether imagining *someone else* performing a simple action can later induce a false memory of *self*-performance. For instance, would the applicant exhibit imagination inflation if s/he had imagined the interviewer rather than her- or himself closing the door? Whereas imagination–inflation studies for these kinds of events have revealed confusions of the modality of action encoding (performance or imagination), it is presently unknown whether the agent of an imagined action can be confused as well.

Among the studies using the above described imagination–inflation paradigm, there is only one study that has employed other-imagination: Seamon et al. (2006) asked participants to imagine the *experimenter* perform actions in Phase 2 (herein called other-imagination). Critically, however, the same participants were also asked to observe the *experimenter* perform actions in Phase 1 (see also Seamon et al., 2009). This condition was compared to a standard condition in which participants performed actions *themselves* in Phase 1 and imagined performing the actions *themselves* in Phase 2. Consistent with this, participants in the first group underwent a source-memory test referring to *other*-performance (i.e., *Did the experimenter perform this action?*), while participants in the second group underwent a source-memory test referring to *self*-performance (i.e., *Did you perform this action?*). Both imagination conditions induced similar proportions of false action memories, however these memories differed with regard to agency: Other-imagination induced flawed recollections of *the experimenter's* actual performance whereas self-imagination induced flawed recollections of *self*-performance. This finding supports the visual-similarity hypothesis inasmuch as similar visual representations are generated when observing as well as imagining *someone else* versus observing as well as imagining *oneself* performing an action (see also Seamon et al., 2006). However, because agency was not crossed in the study by Seamon et al. (2006), two questions remain: Can imagining *another person* performing a simple action not only induce false action memories of *other*-, but also of *self*-performance? If so, will both imagining another person and imagining oneself induce comparable amounts of false action memories of self-performance?

Based on the visual-similarity account outlined above, one would predict that a self-other confusion is possible. However, this account further predicts that the amount of false action memories will be smaller after other- compared to self-imagination: Visual impressions implicated in mental images of other- and self-performance differ with regard to one key aspect, that is, visual perspective. Visual perspective can crucially change one's perception of an action. For instance, locking a door looks quite different from a first- or a second-person perspective. Thus, visual perspective could moderate the amount of false action memories from imagination (e.g., Libby, 2003; Marsh, Pezdek, & Lam, 2014).

Taken together, imagination of another person's actions should be sufficiently potent to trigger false memories of self-performance. However, the altered visual perspective during other-imagination is likely to serve as a non-self cue, which in turn should reduce the amount of false memories compared to self-imagination. To test this prediction, in Experiment 1 we used the imagination–inflation paradigm explained above and varied the imagined agent in the second, imagination phase: Participants were either instructed to imagine *themselves* or to imagine *another person* performing actions. Meanwhile, the agent in Phase 1 was held constant: Actions were performed or not performed by the participants themselves.

In Experiment 2, we further examined the role of visual perspective in imagination inflation. Specifically, we manipulated visual input during initial action performance to match perspectives during self-performance and other-imagination. To this end, we asked participants to observe themselves via a webcam when performing actions in Phase 1. The webcam images created the impression of observing another person facing them. Thus, while perspective was identical between self-performance and other-imagination, perspective was different between self-performance and self-imagination. If visual perspective is critical for the creation of false action memories, we hypothesized that the pattern expected for Experiment 1 would be reversed: We expected a higher amount of false action memories after other-imagination compared to self-imagination.

Cross-experiment comparisons can be used to estimate the influence of visual perspective: Finding a greater effect of other-imagination in Experiment 2 than in Experiment 1 and a smaller effect of self-imagination in Experiment 2 than in Experiment 1 would be in line with such an account. However, cross-experiment comparisons have to be interpreted with caution. To strengthen the empirical basis of our research, we therefore independently manipulated the variables from the first two studies within an extended design in Experiment 3. In this experiment, the agent (self, other) was manipulated both in Phase 1 (performance) and Phase 2 (imagination). Again, if visual perspective is critical for the creation of false memories, imagining oneself should lead to more false *performed*-responses if the actor is the self (vs. other), but this pattern should be reversed when imagining someone else.

2. Experiment 1

2.1. Method

2.1.1. Participants

Thirty-six students of the University of Cologne (30 women) participated for partial fulfillment of curricular requirements. Mean age was 25.33 years ($SD = 5.62$).

2.1.2. Design

We used a 3 (type of encoding in Phase 1: performed vs. read vs. not presented) × 2 (frequency of imagination in Phase 2: 5× vs. 1× vs. 0×) × 2 (imagined agent in Phase 2: other vs. self) design with the last variable varying between participants. This design was not fully crossed inasmuch as action statements not presented in Phase 1 were never presented in Phase 2, but served as distractors at retrieval. The proportion of *performed*-responses in a surprise source-memory test served as dependent variable.

2.1.3. Materials and procedure

Participants were recruited for a study on mental representations of actions and provided informed consent. The experiment was computer-based. All participants were tested individually in two sessions. The involved objects were hidden from participants' view by a cardboard divider.