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Observation inflation and interrogative suggestibility: Different but related memory errors

Abstract: *The observation inflation effect consists in the fact that observing an action being performed can create false memories that this action has actually been performed by the observer. The present study examined the relationship between this effect and interrogative suggestibility. A procedure based on the Gudjonsson Suggestibility Scale was used to assess two kinds of suggestibility: the tendency to yield to suggestive questions (Yield) and the tendency to change answers after feedback (Shift). The participants first watched a film depicting a woman performing simple activities and performed various activities themselves during the film. In order to determine whether the observation inflation effect occurred, the participants performed a source-monitoring test. The observation inflation effect was replicated. Observation inflation correlated positively with Yield but not with Shift. This pattern of results can be explained by the fact these two indicators are different aspects of interrogative suggestibility. Shift is more related to social influence, while Yield is more cognitive in its nature.*

Keywords: *observation inflation; interrogative suggestibility, memory, feedback*

Introduction

Interrogative suggestibility (IS) is one of the major threats to the quality of human testimony (Gudjonsson, 2003), and consequently, it may contribute to erroneous decisions on the part of the court. Indeed, Huff, Rattner and Sagarin (1996) suggested that the most common reason for the conviction of innocent people was, in fact, false and unreliable eyewitness testimonies. Given this fact, the present research is aimed to increase knowledge about IS, and more specifically, to study whether the so called observation inflation (OI) is a correlate of it.

We will start by presenting imagination inflation, a phenomenon on the basis of which OI was developed, then we will introduce OI itself, afterwards we will describe IS, and present our own hypotheses.

Imagining a self-reported counterfactual event increases confidence that this event actually happened (Garry, Manning, Loftus, & Sherman, 1996). This phenomenon is called *imagination inflation* and was first described by Garry and colleagues (Garry et. al., 1996). In their experiment, participants rated the probability of many different possible childhood events occurring. Two weeks later, the participants were asked to create a detailed picture of some of the events that received low subjective probabilities in their individual assessments. Finally, the participants reassessed how confident they were that these events had happened in their lives. It was found that imagining low-probability events increased the confidence that these events actually took place. Since this first study, research has consequently shown that imagining the details of an event that never happened or an activity that was

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never self-performed is enough to produce false memories about them (Garry, Frame, & Loftus, 1999; Goff & Roediger, 1998; Heaps & Nash, 1999; Horselenberg et al., 2000**;** Paddock et al., 1998; Sharman, Garry, & Bueke, 2004; Thomas, Bulevich, & Loftus, 2003).

Increased confidence that an activity has been performed could result not only from imagining self-performance, but also from merely observing when other people perform a given activity. This kind of confusion over whether one indeed performed an action or only watched it is referred to as the *observation inflation* effect (OI). Lindner, Echterhoff, Davidson, and Brand (2010) conducted a series of experiments in which participants performed simple actions or read action statements (e.g., shake the bottle). Later, they observed an actor perform several actions, some of which the participants had not performed earlier. Two weeks later, a source memory test was conducted - participants indicated whether they had or had not performed each activity described in the statements. It was found that observation of other-performed actions induced false memories of self-performance. This effect was successively replicated in several studies (Lindner, Schain, & Echterhoff, 2016; Lindner, Schain, Kopietz, & Echterhoff, 2012; Schain, Lindner, Beck, & Echterhoff, 2012) and also when a different experimental paradigm was used (Lange, Hollins, & Bach, 2017). This successful conceptual replication of the OI effect was conducted in a new paradigm: in pairs, the participants and confederates took turns creating various geometric shapes and letters with their own bodies. The next day, participants were asked to recall either actions they had performed or those they had observed. Not only the inflation observation effect was confirmed, but also the reverse error was observed: participants reported their own actions as those of their partners (Lange et al., 2017).

The observation inflation effect involves confusion over whether an action was actually been performed or was merely observed. This relates to the social nature of memory (Lindner et al., 2012). It has been found that the observation inflation effect is moderated by the skin color of the person performing the activity. The effect was reduced when the actor's skin color was different than the participant's skin color (Linder et al., 2012). Other research shows that the observation inflation effect is decreased if the face of the person performing the activity is visible to participants (vs. the condition where only the activity is visible; Schain et al., 2012). Attention is indicated as one of the determinants of the observation inflation effect: the effect disappears when attention is not focused on the actor performing a given action (Kashihara, Kanayama, Miyatani, & Nakao, 2017). Another characteristic related to the observation inflation effect is age: both young and old adults are prone to this phenomenon, but the magnitude of this effect is greater in those who are older (Lindner & Davidson, 2014).

Further research focused on the mechanisms underlying the OI effect. This mechanism seems to be different from the one responsible for the imagination inflation effect, which is most likely caused by a source-monitoring error (Johnson, Hashtroudi, & Lindsay, 1993; Libby, 2003). In the case of observation inflation, the research indicates that motor simulation during action observation might be the core mechanism underlying false memories of self-performance that are captured by this effect (Lindner et al., 2016; cf. results inconsistent with this interpretation Lange et al., 2017). The corroboration for this thesis was provided by Lindner et al. (2016). In their first experiment from this study, the observation inflation effect occurred even when stimuli were reduced to motion cues (the video showing the performance of the activities was perceptually impoverished). In the second experiment, it was found that performing incongruent as compared to congruent movements (in order to prevent motor simulation) decreased the observation inflation effect.

The second main construct researched in the present study, interrogative suggestibility (IS) is defined as "the extent to which, within a closed social interaction, people come to accept messages communicated during formal questioning, as a result of which their subsequent behavioral response is affected" (Gudjonsson & Clark, 1986, p. 84). IS comprises two main factors: Yield, which is the tendency to include in answers details congruent with suggestions included in misleading questions; and Shift: the tendency to give different answers as a result of negative feedback (Gudjonsson, 1984). The theory of IS is based on three constructs (Gudjonsson, 1997): uncertainty, interpersonal trust, and expectation to succeed. Uncertainty refers to the interviewee being unsure of the correct answer to a question. Interpersonal trust means that an average witness usually does not doubt the interviewer's truthfulness or suspect that they will convey incorrect information or otherwise mislead them. Expectation to succeed refers to the interviewee's conviction that they will know the answers to the questions asked (Gudjonsson, 1997). When all these three premises are present, most people will be suggestible to some extent (Gudjonsson, 1997).

Aim of the study and hypotheses

The main aim of the present study was to examine whether there is a relationship between susceptibility to OI and IS. We predicted that there would be a positive correlation. The rationale for this hypothesis is based on following premises. First, both OI and IS involve and assume imperfect memory. In the context of IS, it has been repeatedly confirmed that memory quality is a negative predictor of IS (e.g. Gudjonsson, 1987, 1988; Polczyk et al., 2004). In connection with IOs we are not aware of such research, but it can be reasonably assumed that poor memory contributes to this effect. If this is the case, a positive correlation between IO and IS should be expected.

Another common denominator for OI and IS is memory confidence. Uncertainty of memory is essential for IS (Gudjonsson, 1997) and is in fact included in the theory of IS - as above mentioned, uncertainty of one's memory is a core premise for IS: people who are

completely confident in their memories have very low or no IS (Gudjonsson, 1997). We speculated that memory confidence is related to OI as well: people who are very confident in their memories should be less prone to this effect.

Apart from the above mentioned premises, OI may be considered a kind of susceptibility to suggestion, just as IS: someone observed something and then it is suggested to them that they did it themselves by means of questions which apparently allow for a possibility that a given action was performed (while actually it was merely observed).

In order to measure IS we developed a technique which was based on the Gudjonsson Suggestibility Scales (GSS; Gudjonsson, 1997). GSS involves negative feedback. We decided to include positive feedback in the experiment as well. Although not included in the standard GSS procedure, it is nevertheless relevant in the case of a forensic interview, and its impact may vary depending on the subject's previous behaviour. Gudjonsson (2003) analyzed four settings: (1) suggestible behavioural response followed by positive feedback; (2) resistant behavioural response followed by positive feedback; (3) resistant behavioural response followed by negative feedback, and (4) suggestible behavioural response followed by negative feedback. In the first setting positive feedback should reinforce the suggestible behaviour of the witness, while in the second setting it would reinforce resistant behaviour. In sum, the effects of positive and negative feedback may be different, so we decided to study both of them.

Method

Power analysis

Power analysis was done by means of the G*Power software (Faul, Erdfelder, Buchner, & Lang, 2009). A 2 × 2 ANOVA with within-subjects factors was planned, as well as correlational analyses. As for the ANOVA, the current version of G*Power (3.1.9.6) cannot do power analyses for repeated measures designs with more than one within-subject factor and their interaction. Because of this, the power was estimated for the main effects, as if there was one factor only. Correlation between repeated measures was assumed to by $r = 0.5$. For the small, medium and large effect sizes ($f = 0.1$, 0.25, and 0.4, respectively), the required sample size for the power of 80% was 327, 54, and 23. Thus, the planned sample ($N = 62$) was big enough to detect medium and large effect sizes.

As for correlations, one-tailed significance tests and power of 80% were assumed. Pearson *rs* equalling 0.1, 0.3, and 0.5 were assumed as small, medium, and large effect sizes, respectively. The required sample sizes were 614, 64, and 21, respectively. Obviously, the assumed sample size (62 participants) was appropriate to detect medium and large effects, but not a small one. This applies to the correlational analysis involving Yield (see description od Yield and Shift below). As for Shift, the situation is worse, as there were two kinds of feedback and therefore two groups of 31 participants. This sample only allows for detecting large effects and therefore insignificant correlations should be interpreted with caution in this case. However, given the complexity of the experimental procedure and scarcity of resources, a substantially larger sample was not possible.

Participants

The 62 people (33 women and 29 men) who participated in the study were invited to take part via social networks. Their average age was 26.34 ($SD = 9.95$). The participants did not receive any money or other gratification for participating in the study.

Materials

Observation inflation. The study used a film without sound lasting 14 minutes and 20 seconds. The film alternated between presenting various activities performed by an actress, such as opening a box or touching an ear, and instructions for the subjects. To minimize gender conformity, the actress wore gender neutral clothes and her hands and her face were made to look gender neutral (i.e. nails were not painted, her hair was short). The participants were asked, for example, to close the box or touch their nose. They had 10 second to complete each action. The participants carried out the commands displayed on the film using the items on the table on their left side (it was irrelevant which hand was dominant or which hand the participants performed the activity) Such location of the table was derived from the research of Lindner et al. (2010). The objects on the table were identical to those shown in the film. However, the participants were asked to use only some of them. In addition, there were also items that were shown only on the film and the participant was not asked to use them. There were also items on the table that were not shown in the film, and the participants were not asked to use them.

The source memory test contained 30 statements describing activities such as *opening a box*, and the respondents were asked to mark one of four answers: *a) I did it, b) I watched it, c) I did it and watched it, d) I neither did it nor watched it*. It was clearly explained that the option '*I did it*' was to be chosen only if the participant believed that they were doing an action but were not seeing the actress doing it. Fifteen statements contained critical details and concerned activities performed exclusively in the film. Answers *I did it* or *I did it and I watched it* relating to critical items were considered to be the occurrence of the observation inflation phenomenon. For example, the participants watched the actress open the box on film but did not do it themselves. The answer to the question about opening the box '*I did it*' or '*I did it and I watched it*' indicated the OI effect.

Based on the 15 critical items, two indexes were calculated: the first was based on the number of "*I did it*" answers; the second was based on the number of "*I did it and watched it*" answers (they do not sum up to 100% as two other answers were always possible). The first index indicates observation inflation in a 'stronger' sense, which indicates that a participant thought they had done some-

thing and did not realize that they had also watched it. The second index still indicates that OI was present, but here the participant realized that they had watched an activity, although they wrongly believed that they had also performed it. The first, stronger index was called OI-d (doing); the second, weaker one was called OI-wd (watching and doing). OI-d and OI-w were also computed for the control questions, which referred to activities which had never been watched in order to provide a control condition for the OI effect.

The main aim of the study was to analyze the correlation between the IO and the IS, rather than an in-depth analysis of the OI effect itself. In order to ensure the highest possible reliability of the measurement of OI, it was based on as many items as possible (15). This was at the expense of the number of control items (3), which only served to confirm that the effect of the OI existed at all. The use of a very large number of control items was not possible because it would have made the procedure too long. As there were 15 critical items and only three control items, the results were expressed as means. The answers were coded as 0 = observation inflation not endorsed, and 1 = observation inflation endorsed. Thus, the scores had ranges from zero to 1.

Interrogative suggestibility. The procedure for measuring IS was based on the GSS (Gudjonsson, 1997) but was modified in order to be better integrated in the procedure. In the original GSS, a story is read aloud to the participants, and after a break, 20 questions are being asked, 15 of which include misleading cues. The number of answers consistent with the misleading cues constitutes Yield - the tendency to give answers consistent with misleading premises included in the questions. After all the questions are asked, negative feedback follows, and all questions are asked again. The number of changes in the answers constitutes Shift - the tendency to change answers after negative feedback.

In the present experiment, instead of a story, the film described above served as the material to be remembered. The testing phase consisted of 20 questions and two answers to choose from. Fifteen of the questions and the options for answers were suggestive; e.g. '*On which finger did the actress have a ring while hitting the table? - On the middle finger / On the ring finger?*', while in fact the woman shown in the movie did not have any ring. The remaining five questions were buffers, that is, an answer based on the film was possible and the question did not suggest anything.

Each answer consistent with the misleading suggestion was scored one point. In total, a maximum of 15 points could be obtained on the Yield scale (the tendency to give in to misleading cues). Afterwards, feedback was applied. The negative version was as follows: '*You have made a number of errors, therefore please complete the test again, and this time try to be more accurate*'. The positive feedback was: '*You did very well, you have made few errors, so please complete the test again and try to find them*'. Each answer clearly different from the previous one was scored one point, giving the index of Shift (the tendency to change answers) with a range from 0 to 20.

Procedure

The participants were informed that they are taking part in a memory study. In the first part, the subjects watched a film that alternately depicted a woman performing various activities and instructions for the subjects to carry out using the items on the table on their left side. Some commands were supposed to be done using only their own hands, e.g. '*touch your nose with your finger*' or '*bang your fist on the table*'. After the movie finished, all items on the table were covered. Immediately after the film ended, the respondents were asked to list all the activities: both those seen in the film and those which they had been asked to perform. This part served to authenticate the purpose of the study and to provide the experimenter with an initial estimate of the memory capacity of the subjects. After recalling all the activities that the subject was able to remember a 50-minute break followed during which the participants filled out a number of questionnaires not related to the subject of the study.

After the break, the subjects were again asked to list all the activities from the first part of the experiment. They then completed the information source memory test concerning OI. Afterwards, they performed the memory test concerning IS: they were asked to complete a memory test consisting of 20 questions, including misleading questions as described above. Next, regardless of the result obtained, for half of the participants positive and for the other half negative feedback was given and the participants answered all 20 questions again. Finally, the participants were debriefed.

Results

First of all, the presence of the observation inflation effect was analyzed. To analyze the it, a two-factor analysis of variance was applied with two within-subjects factors: OI-manipulation (critical *vs*. control questions) × OI-type (OI-d *vs*. OI-wd). The means across experimental conditions are presented in Table 1.

The main effect of observation inflation proved significant (means: 0.32 *vs*. 0.01; $F(1, 61) = 452.64$, $p < .001$, $\eta^2 = .88$). As can be seen, the number of answers indicating that a participant believed that they had performed an activity (while in fact they had only watched it) was extremely low in the control condition (about 1% of items endorsed). The main effect of the type of the OI (OI-d *vs.* OI-wd) was also significant, with OI-wd being much

Table 1. Mean numbers of answers mentioning 'doing' an activity (standard errors) across experimental conditions

	Critical items	Control items	Total
OI-d	0.08 (0.01)	0.01 (0.01)	0.04 (0.01)
OI-wd	0.56 (0.02)	0.02 (0.01)	0.29 (0.01)
Total	0.32 (0.01)	0.01 (0.01)	

OI-d, observation inflation – doing; OI-wd, observation inflation – watching and doing

more endorsed than OI-w (means: 0.29 *vs*. 0.04; $F(1, 61) = 474.51$, $p < .001$, $\eta^2 = .89$). The interaction of the OI-manipulation and OI-type factors was also significant ($F(1, 61) = 449.86$, $p < .001$, $\eta^2 = .88$). Subsequent analyses of simple effects indicated that the differences between critical and control items were significant for both OI-d ($F(1, 61) = 27.81$, $p < .001$, $\eta^2 = .31$) and OI-wd ($F(1, 61) = 588.34$, $p < .001$, $\eta^2 = .91$). In sum, these results confirm the existence of the OI effect, although it was much stronger in the case of the less strict measure.

As mentioned above, OI-d was very rare and close to floor effects. This inevitably restricts its range and may cause correlational effects to be insignificant. Following analyses were performed for both OI-wd and OI-d, but the results for OI-d should be treated with great caution.

The next hypothesis concerned the relationship between OI and IS. Table 2 presents the results of Pearson *r* correlations concerning these hypotheses. As for Shift, it was calculated separately for the positive and negative feedback.

In accordance with the hypothesis, yielding to suggestive cues was positively related to the tendency to give in to observation inflation; however, this was the case only with observation inflation measured in the less stringent way. No significant correlations were found between OI and the tendency to change answers after feedback. Thus, the hypothesis postulating a relationship between OI and IS was only partially confirmed.

Table 2. Correlations between observation inflation and interrogative suggestibility

	IO-wd	IO-d
Yield	.30*	.05
Shift - positive feedback	.15	-.04
Shift - negative feedback	.01	-.07

OI-d, observation inflation – doing; OI-wd, observation inflation – watching and doing

Finally, it was found that Shift was much higher in the case of negative than positive feedback (means: 4.58 *vs*. 1.51, *SD*: 3.17 and 1.73; $t(60) = 4.58$; $p < .001$, $\eta^2 = .26$).

Discussion

The present study first sought to replicate the observation inflation effect (OI), which means increased confidence that a participant performed a given activity when in fact they only watched another person doing it. The main aim was to analyze the correlations between the tendency to give in to OI and both aspects of interrogative suggestibility (IS), which is the tendency to give answers consistent with misleading suggestive cues included in questions, and the tendency to change answers after being given feedback concerning the answers given so far.

OI was operationalized in two ways in the present study: as '*I did it*' and '*I did it and watched it*' answers. In the first case, OI was measured more strictly as a belief that a participant thought they had performed a given activity without realizing that they had merely watched it. In the second case, OI is operationalized less strictly, as in this case participants knew that they had watched a given activity being performed by somebody else but also erroneously believe that they had also performed it.

The OI effect was present in the case of both these kinds of operationalization. This confirms its replicability. The present results also mean that the OI effect can be elicited in various ways, as the details of our experimental procedure differ somewhat from that applied by Lindner et al. (2010), e.g. no reading aloud of the actions or unscrambling of them was applied. Also, in the study by Lindner et al. (2010), the procedure actually consisted of two parts: Phase 1 – encoding of actions (performed vs. only read vs. not presented); next, after two weeks; Phase 2 – presentation (presented vs. not presented) and processing (observed vs. imagined vs. generated vs. read). In the present study, a much simpler procedure was used. Most importantly, no two-week time delay was applied, and instead 50 minutes separated the first phase (watching vs. doing) and the final source memory test. Also, Lindner et al. (2010) did not differentiate between the more and less strict way of measuring OI. Despite these rather substantial procedural differences, we were able to replicate the main idea of OI. Existing replications of OI (Lange et al., 2017; Lindner et al., 2012, 2016; Schain et al., 2012) also differed somewhat from the original procedure used by Lindner et al. (2010). This confirms the universality of this effect.

Of course, calling the OI-d and OI-wd options as indicators of a stricter and a more lenient manifestations of OI is a metaphor only. The results however are comparable to a similar source monitoring test, concerning the memory misinformation effect. In this paradigm (e.g. Zaragoza & Lane, 1994), the participants watched a film and read a summary of it, in which details that were not actually on the film were mentioned, e.g. a gun. The final source monitoring test forced the participants to choose one of four options: '*Saw*' (i.e. it was on the film), '*Saw and read*' (it was on the film and in the text), '*Read*' (it was in the text but not on the film), and '*Neither*' (it was neither on the film nor in the text). The first and second answers were considered to be indicators that misinformation has affected memory. The option indicating that the participant thought they have seen something they have actually only read about and did not realize that they have read about it, occurred rarely (Zaragoza & Lane, 1994).

The main hypothesis verified in the present study stated that the tendency to give in to the observation inflation effect would be positively related to interrogative suggestibility. As for Yield, this hypothesis was confirmed in the case of the less strict measure of OI. This may be explained by the fact that in the case of the stricter measure (the belief that one performed an activity without realizing that it was only observed) the mean was very close to zero

(0.08, compared with 0.56 in the case of the less strict measure). Therefore, its variance was limited, and as Pearson's *r* coefficient is very sensitive to the variance of both variables being correlated, no significant effect was present. In the case of Shift, however, no significant relationships were found at all.

The fact that OI was related to Yield but not to the Shift may be explained by the fact that they are actually very different aspects of interrogative suggestibility. Yield is more cognitive in its nature, while Shift is more related to social influence. In the case of Yield, the participant may have actually been unaware that they had been subjected to any sort of influence or suggestion. Relying on suggestive cues included in the interviewer's questions is probably more similar to filling gaps in memory. As mentioned in the Introduction, three elements are essential for interrogative suggestibility to arise (Gudjonsson, 1997): uncertainty, interpersonal trust, and expectation to succeed. All these factors foster relying on (mis)information included in the questions, not only in the original story. However, the participant may be not aware that any pressure is present. Thus, a correlation between observation inflation and relying on additional cues is understandable because both assume a certain inadequacy in a cognitive function, namely memory.

Things start to be different in the case of Shift. Here the participant is overtly 'informed' about their level of performance. In the classical operationalization of IS, i.e. GSS scales (Gudjonsson, 1997), the feedback is negative; in the present study, positive feedback was also applied in one of the groups. Negative feedback usually results in reduced self-esteem and confidence and increased tendency to change answers in order to achieve 'better' results. This may be unrelated to observation inflation, in which no overt influence of any kind, especially no feedback, is present. As for positive feedback, it may not cause increased tendency to change answers, but it is still a kind of feedback. As the observation inflation procedure did not include any feedback, this may explain the lack of correlation in this case.

Limitations and Future Directions

One of the limitations of the present study is the fact that a simplified procedure for analyzing the observation inflation effect was applied. Such simplification was necessary because the experiment involved another procedure which is also quite complicated, namely, measuring interrogative suggestibility. Both these procedures are quite challenging for both the participants and the experimenter, so they were simplified as much as possible.

In the OI procedure, no counterbalancing between critical and control items was applied, and the procedure included more critical items than control items. We did it this way because one of the main aims of the present study was to analyze the relationship between the tendency to be susceptible to observation inflation and interrogative suggestibility. The longer scale ensured better reliability and larger variance, resulting in better power to detect correlations. It can be noted that no counterbalancing is applied also in the classical procedure for measuring interrogative suggestibility, the Gudjonsson Suggestibility Scales (Gudjonsson, 1997), on which the present procedure was based.

The statement that Yield is linked to IOs may have some consequences for the applied forensic psychology applied and especially for research in this area. Perhaps in order to assess the susceptibility of a witness to suggestive questions it is worth to do other tests, examining the susceptibility to various other distortions of cognitive processes, including IOs. In any case, it is worthwhile to do further research to analyze what other types of cognitive distortions may be related to the tendency to yield to suggestive questions.

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