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Effects of visual imagery on false memories in DRM and Misinformation paradigms

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Abstract

This study examined the possibility that moderators of false memories in the Deese-Roediger-McDermott (DRM) paradigm affect the occurrence of false memories in the misinformation paradigm. More precisely, the purpose was to determine to what extent an imaging instruction modulates false memories in the DRM and misinformation paradigms. A sample of young adults was assigned to the DRM or the misinformation tasks, either in control conditions or in conditions including an imaging instruction. Findings revealed that an imaging instruction decreases false memories in DRM whereas there is no evidence about imaging effects in the misinformation task. These observations tally with previous studies, reporting a weak or no correlation between false memories in these paradigms, and are discussed in the light of current theories.

(122 words)

Keywords: *DRM; false memories; imagery; imaging instruction; misinformation*

Effects of visual imagery on false memories in DRM and misinformation paradigms

After numerous demonstrations of the presence of false memories in the Deese-Roediger-McDermott (DRM, Roediger & McDermott, 1995) and the misinformation paradigms (Loftus, Miller, & Burns, 1978), the cognitive processes involved in these phenomena are becoming better known. It has notably been demonstrated that the Activation Monitoring Theory (AMT, Roediger, Balota, & Watson, 2001) could be one of the best explanations of the DRM illusions, while the Source Monitoring Framework (SMF, Johnson & Raye, 2000) is probably the most appropriate for describing false memories in the misinformation paradigm.

The DRM paradigm consists of presenting a series of lists of words that are semantically associated with a thematic word, called the critical lure (the most strongly associated word), which is never presented. According to the AMT, DRM illusions result from the activation of words highly associated with the word lists and a failure in monitoring during retrieval, impeding the possibility to distinguish between the words on the lists and those generated during encoding.

Source monitoring (Lyle & Johnson, 2007) refers to the ability to remember and correctly attribute the origin of information retrieved from memory. Remembering the source refers to the original context in which the information was presented. According to the SMT, memories, which contain specific details (sensorial, contextual, or linked to the mental operations that produced them), are more easily distinguished as having been seen or imagined.

Nevertheless, despite their differences, some researchers suggested that the false memories in these paradigms (DRM and misinformation) may rely on similar mechanisms: “both types of errors could be seen as source monitoring failures” (Ost, Blank, Davies, Jones, Lambert, & Salmon, 2003, p. 5). However, findings have shown that individuals prone to false DRM memories are not as likely to produce misinformation effects (Ost et al., 2013; Patihis,

Frenda, & Loftus, 2018; Zhu, Chen, Loftus, Lin, & Dong, 2013). James Ost's research was the first study published on this issue. This author and his colleagues compared false memories in a within-subject experimental design using DRM word lists and a short video footage, with recall and recognition tests. Although false memory rates were of the same magnitude, they were not correlated. The merit of Ost's work was to point out that the mechanisms underlying false memories seem to be specific to each paradigm.

Based on this finding, we may wonder whether false memories might be affected by the same factors, independently of the experimental paradigm in which they are examined. For instance, findings have shown a reduction of false memories when participants encode DRM lists with the instruction to generate a visual image of the object designated by each word (Foley, 2012; Robin & Mahé, 2015). With respect to the AMT (Roediger, Watson, McDermott, & Gallo, 2001), imaging instructions lead participants to focus on the visual characteristics of the objects corresponding to the words studied that are depicted in their visual images, thus reducing the activation of associated words. During retrieval, visual images enable reliable source monitoring based on visual characteristics. The retrieval of these distinctive details (i.e. visual images) allowed participants to accept an item as previously seen or heard. Alternatively, in accordance with the distinctiveness heuristic hypothesis (Dodson & Schacter, 2001; Israel & Schacter, 1997), visual images built during encoding help monitor cues during the retrieval test in order to distinguish lures from the words studied. This decision strategy is based on the distinctive characteristics of the encoding condition. Building visual images during encoding becomes a decision criterion at the time of retrieval, with the lures not being associated with the images rejected (Robin & Mahé, 2015).

In contrast, studies that have examined the effects of visual imaging on misinformation are still sparse. Therefore, caution is required regarding the hypothesis that visual imaging encoding may be a good candidate for reducing every sort of false memory of an event. The

misinformation paradigm is quite similar to the interviews in which eyewitnesses are asked to remember a scene while evoking an image and describing it in detail. Yet the presence of vivid and detailed images does not guarantee the veracity of the information collected (whether the images are accurate or suggested). Hence, the pending issue is to discover whether the reduction in false memories obtained via imagery instructions in the DRM task might be extended to ecological contexts such as eyewitness testimonies. Therefore, our aim was to investigate the impact of imaging instructions on false memories across the DRM and misinformation paradigms, by using the same kinds of imaging instructions and memory tasks (recognition tests) in a between-subject design. Five groups of participants completed the experiment. Two groups in the DRM task: (1) an experimental group with an imaging instruction; (2) a standard control group without the imagery instruction. Three groups in the misinformation task: (1) a standard control group without the imagery instruction; (2) a first experimental group with an imagery instruction during the misleading questionnaire; (3) a second experimental group with an imagery instruction during the recognition test.

In the DRM paradigm, the instruction to imagine the words studied, implemented at encoding, should reduce the activation of critical lures, producing distinctive memory traces supporting subsequent source monitoring. Therefore, we expected to replicate previous results showing that imaginal coding reduces false DRM memories (Foley, 2012; Robin & Mahé, 2015).

In the misinformation paradigm, imagery processes during the completion of the post-event questionnaire were expected to amplify the real and plausible nature of the inaccurate events suggested, and thus increase their similarity with the original event. This should result in increasing source confusion and therefore heightening the misinformation effect. Therefore, we expected a fall in the number of correct answers to true information and a rise in incorrect answers to the inaccurate information. These performances should be accompanied by a higher

feeling of confidence in the misleading information. Studies examining the effects of visual imaging in misinformation paradigm are scant. However, numerous studies regarding the paradigm of false autobiographical memories have shown that imagination increases the participant's confidence in suggestions of erroneous events (for a review, see Robin, 2010). This phenomenon, known as inflation of the imagination, occurs when an imagined event reinforces the individual's certainty or belief that the event actually happened (Mazzoni & Memon, 2003).

In contrast, the imagery processes during the recognition task were expected to enhance memory monitoring. This hypothesis is based on imagery theories (Paivio, 2007) which claim that figurative materials are automatically depicted in a visual image. Therefore, the imaging instruction should refresh the visual images of the original event. This should increase correct answers and reduce the reliability of inaccurate suggestions. Consequently, in this condition, we should obtain better discrimination of source information, i.e. a reduction in false memories.

Method

Participants and design

Two hundred students (81% women, 19% men), with a mean age of 19.77 years ($SD = 1.87$), participated in the experiment. They were first-year psychology students from the Universities of Nantes and Angers, who had never studied the main topics of this experiment before. All were French native speakers.

Regarding the DRM paradigm, two conditions were examined in which words were presented orally, with an explicit imaging instruction asking participants to generate a visual image of the object corresponding to each word of the DRM lists (the imagery condition) or without any such instruction (the control condition). The methodology followed was that of the standard DRM paradigm, that is an intentional memory condition (Roediger & McDermott,

1995). Eighty participants (mean age = 20.62; SD = 2.42; range: 18-28) were randomly, and in equal number ($n = 40$), assigned to one of the two conditions.

For the misinformation paradigm, the chosen methodology was a French adaptation of Loftus' work, including three steps: (1) visualization of an event (a short movie sequence); (2) answering an unexpected questionnaire containing misleading suggestions about the movie sequence; (3) performing a recognition task about details of the original event (Loftus et al., 1978; Mahé, Corson, Verrier, & Payoux, 2015). As previously mentioned, the video footage automatically induces a visual processing leading to the production of visual images of the events. Therefore, adding an explicit imagery instruction during the encoding stage was not relevant. Thus, the three following conditions were examined: a control condition without an explicit imaging instruction, and two experimental conditions with an imaging instruction either during the misinformation phase or during the recognition phase.

120 participants were randomly assigned in equal number ($n = 40$) to one of the three conditions of the misinformation paradigm (mean age = 18.92, SD = 1.32; range: 17-26). None of the participants who took part in the DRM task participated in the misinformation task, and conversely.

Materials

The DRM task was composed of ten lists of eight words strongly associated with a critical lure. These lists were originally developed by Corson, Verrier, and Bucic (2009), using the same criteria as Roediger and McDermott (1995). The words were presented in order of decreasing associative strength to the non-presented related word. The eight highest associates that could be depicted in a visual image were included in the ten lists (see Robin & Mahé, 2015). In previous studies, it was ensured that the imagery value of critical lures was high and the same as the imagery value of all the words studied. The word lists were recorded in a female voice

and presented to the subjects through headphones. Two presentation orders of the lists were used. In each condition, each of the study items was presented for three seconds, meaning that encoding time was the same in both experimental conditions.

A subset of the words presented during the encoding phase was included in the recognition test. The latter consisted of 64 words including: 30 of the *studied words* selected from the presented items in each list (and occurring in the first, third and seventh positions in the lists); 10 non-presented *critical lures*, each being a high associate of the words presented in the lists; 24 *distractors* selected from six other DRM lists that were not presented and unrelated to the studied and critical lures. Items on the recognition list appeared in alphabetical order. Every word was rated with a four-point scale with 1: “*sure it is new*”, 2: “*probably new*”, 3: “*probably studied*” and 4: “*sure that the item was studied*”.

The misinformation task consisted of the projection of a short video composed of scenes selected from the film “Z” (Perrin, Rachedi, & Gavras, 1969), initially tested by Mahé et al. (2015), and first used by Loftus, Levidow, and Duensing (1992). The short video, of a duration of 6 minutes 19 seconds, describes the assassination attempt of a politician who decided to organize a political rally. As “Z” is an old film, it is generally unknown to young participants.

The misinformation questionnaire used in this research was similar to the one developed by Mahé et al. (2015), according to Loftus’ studies (Loftus et al., 1978, 1992). Twelve open questions on the video sequence were presented in chronological order. Most of them concerned the visual aspects of the events. Four questions suggested consistent information (e.g. at the end of the film, when everyone is gathered in the public square, *a blue vehicle* arrives at high speed. What type of vehicle is it?), four misleading questions suggested inaccurate information (e.g. *blue* was replaced by *white*), and four neutral questions suggested no information concerning

the event (e.g. *a vehicle* arrives at high speed ...). There were three versions of the questionnaire so that every question was presented to the participants the same number of times in a consistent, misleading, or neutral way. The effect of question order was controlled by making sure no questions of the same type (consistent, misleading, or neutral) followed each other. The number of participants was similar for each version of the questionnaire.

The recognition test contained 12 questions regarding the consistent, inaccurate and neutral information to which the participants were exposed during the misinformation phase. The questionnaire administered consisted of a two-alternative forced choice task, for which the participants had to choose between two answers referring to the consistent or inaccurate information. For each question, participants had to indicate their confidence rating on a five-point Likert scale (from *not sure at all* [1] to *completely sure* [5]). All participants received the same version of the recognition test, in which the questions were presented according to the chronological order of events occurring in the movie. The correct response was systematically the first of the two alternatives proposed. Moreover, two additional questions ensured that participants had not seen the film before (none of them had), and had not guessed that the study concerned false memories or any related subject.

Procedure

In the DRM task, participants completed the experiment individually. Following their consent, they received the instructions. In the control condition, participants were simply instructed to pay careful attention to each word in order to carry out another task using these words later on. In the imaging condition, participants were instructed to imagine each object depicting the word and rate the vividness of their image on a 1 to 7 point scale (ranging from “*no image*” to “*an image as vivid as real vision*”). After studying the ten lists, all the participants performed the incidental recognition test.

In the misinformation task, participants were divided in three conditions. In each condition, the experimentation comprised three phases and was led during a first-year methodology course at the university. In each group, the participants watched the movie together. Their sole instruction was to pay full attention to the video. Although the conditions were identical to those used in Mahé et al.'s study (2015), we ensured that the viewing conditions of the film sequence were optimal and rigorously identical for all participants regardless of the experimental conditions (same screen size, same lighting, sound, etc.). An hour and a half after viewing the film extract, and without prior warning, participants were invited to answer the twelve open questions of the misinformation questionnaire. One week later, during the same class, the participants performed the forced-choice recognition test about the film sequence they had watched before. Participants had to choose between the right answers (consistent) or the false answers (inaccurate). For each answer, they estimated their feeling of confidence on the five-point scale described previously. In the three conditions, the procedure was exactly the same, except that in the imaging-misinformation and the imaging-recognition conditions, participants were instructed to imagine the scene described in each question as vividly as possible (i.e. as if the scene were unfolding before their eyes) during the misinformation or the recognition phases respectively. Then, all participants were debriefed about the experiment's objectives.

Data analyses

Analyses were conducted to ensure that false memories were observed in the DRM task, as well as in the misinformation paradigm. We also led analyses to determine whether the imaging instruction had an impact on any of these tasks and if so, what the pattern of this effect was. We performed conventional analyses (metric and frequentist) on all of the measures of interest so as to compare our results with previous studies on the topic. We also applied

multilevel Bayesian ordinal analyses on our main outcome (false memories) in order to i) increase the number of observations used in the analyses, ii) fit more precise models (e.g. see Bürkner & Vuorre, 2019; Liddell & Kruschke, 2018) and iii) model any varying effects for both participants and items.

Results

1. DRM and imagery effects

Frequentist analyses

The mean ratings of responses on the 4-point scale were compared for both conditions (control vs imagery). Table 1 presents the mean ratings of responses (from 1 to 4) for each encoding condition and each item type. An ANOVA with repeated measures was carried out with Item type as a within-subject factor (studied words, lures and distractors) and Condition as a between-subject factor (control vs imagery). The analyses revealed a significant effect of Condition, $F(1, 78) = 9.77, p = .002, n^2_p = .11$, and a significant effect of Item, $F(2, 156) = 422.29, p < .001, n^2_p = .84$, which indicated the presence of false memories in the DRM paradigm. Indeed, post-hoc analyses (Bonferroni) indicated that recognition rates of studied words were significantly higher than the recognition rate of lures, $t(78) = 15.56, p < .001$, Cohen's $d = 1.741$. False recognitions of lures were higher than false recognitions of distractors ($M = .05; SD = .06$), $t(78) = 13.488, p < .001$, Cohen's $d = 1.506$.

The analyses also reported a significant Condition x Item interaction effect, with $F(2, 156) = 13.98, p < .001, n^2_p = .15$. Post-hoc analyses (Bonferroni) showed that mean ratings for studied words were not significantly different in the two conditions, $t(78) = 2.40, p = .25$. However, mean ratings for lures were significantly lower in the imagery condition compared to the control condition, $t(78) = 4.81, p < .001$, confirming better rejection of lures when they were

not studied with an imagery instruction. Mean ratings for distractors were lower in the imagery condition, $t(78) = 2.98$, $p = .05$, revealing fewer intrusions with an imagery encoding.

Table 1. Ratings of responses on a 4-point scale for each item type in each experimental condition

Mean ratings (standard deviation) of responses (1-4)			
	Studied words	Lures	Distractors
Control	3.41 (.03)	2.61 (.08)	1.50 (.03)
Imagery	3.66 (.03)	2.10 (.06)	1.18 (.02)
Mean proportions (standard deviation) of “old” responses (3-4)			
	Studied words	Lures	Distractors
Control	.81 (.11)	.54 (.28)	.08 (.07)
Imagery	.91 (.07)	.35 (.24)	.03 (.04)

Note. The mean proportions of “old” responses (i.e. responses 3 and 4 on the rating scale) associated to each item type correspond to items identified as previously studied, and thus refer to correctly recognized *studied words*; false recognitions of *lures* (non-studied, associated with the studied words); and false recognitions of *distractors* (non-studied, not associated with the studied and critical lures).

Bayesian analyses

A multilevel Bayesian ordinal regression was fitted with Item type as a within-subject factor (studied words, lures and distractors, respectively coded 1, 0 and -1 as a linear contrast) and Condition as a between-subject factor (control vs imagery, respectively coded 0.5 and -0.5) as well as their interaction as fixed factors and varying intercepts for participants and items (words) in the model. The dependent variable corresponded to the response of the participants

(1, 2, 3, or 4). Data analysis was performed with the brms R package (Bürkner, 2018). Dispersion of each participant's responses as a function of item type and experimental condition is depicted in Figure 1.

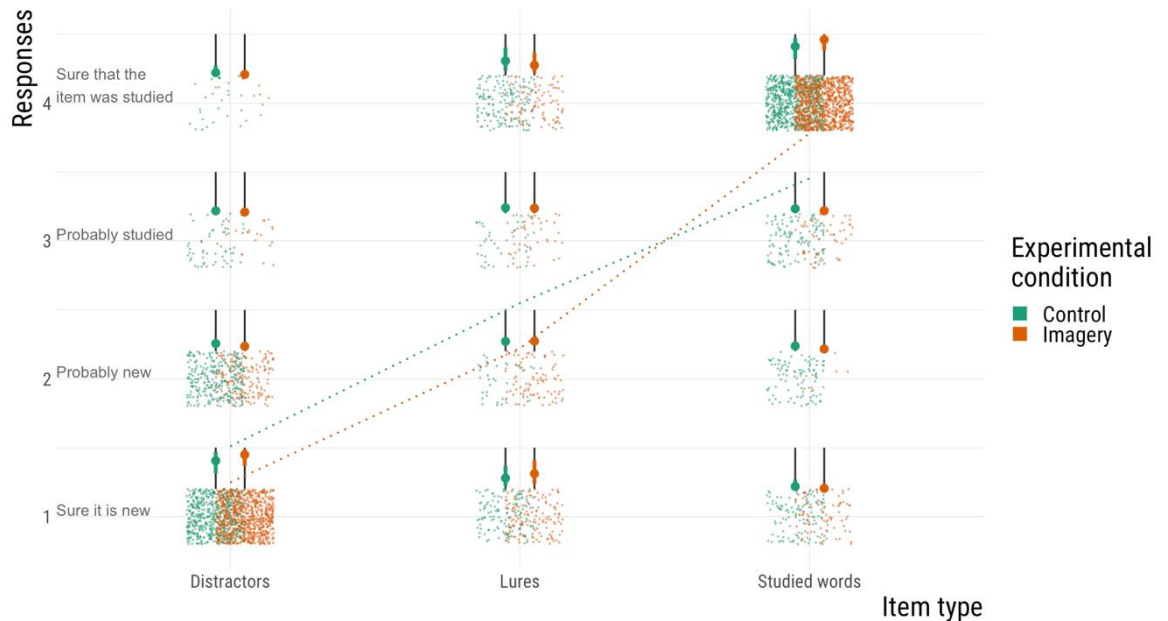


Figure 1. Responses as a function of item type and experimental condition.

In Figure 1, each small dot represents a participant's response (the position of each dot was slightly modified for readability). Above, the larger dots represent estimates of response probability and are presented along with their 95% CI (credibility interval) as estimated by the model. Dashed lines link the weighted average response in each condition computed from the probability of each response (by condition) estimated by the model.

There was no evidence of an (absence of) effect of Condition, $\beta = 0.03$, 95% CI [-0.13, 0.19], but a substantial effect of Item type, $\beta = 1.28$, 95% CI [1.18, 1.37], was found, indicating that rates of veridical recognition for the studied words were higher than false recognitions of lures, which were higher than false recognitions of distractors. When the Item type variable was coded as an orthogonal contrast (-1, 2, -1), there was no evidence of an (absence of) effect of

this variable, $\beta = -0.04$, 95% CI [-0.32, 0.25], suggesting that the linear contrast was the best model. The analyses also reported a substantial Condition x Item type interaction effect, $\beta = -0.52$, 95% CI [-0.60, -0.44], suggesting that the effect of imagery (vs. control condition) on accuracy was more significant for higher values of the linear contrast (see Figure 1).

These results replicated those found in previous studies showing a constant reduction in false memories with an imaging instruction (Foley, 2012; Robin & Mahé, 2015).

2. Misinformation and imagery effect

In the control condition, we expected a higher rate of correct responses for consistent and neutral information than for misleading/inaccurate information (see Mahé et al., 2015). The imaging instruction during the misinformation questionnaire should increase the misinformation effect. In contrast, the imaging instruction during the recognition test should reduce the misinformation effect, as participants refresh their mental images of the original scenes.

Frequentist analyses

The mean proportions of correct answers collected for each question type as a function of the experimental condition are shown in Table 2.

Table 2. *Mean proportions (standard deviation) of correct answers for each Question type (consistent, neutral, misleading) in each experimental condition (control; imagery-misinformation; imagery-recognition)*

	Consistent question	Neutral question	Misleading question
Control	.89 (.16)	.85 (.19)	.64 (.18)

Imagery-misinformation	.84 (.18)	.82 (.16)	.69 (.21)
Imagery-recognition	.85 (.21)	.84 (.18)	.67 (.26)

A repeated-measures ANOVA was carried out with Question type as a within-subject factor (consistent, misleading, neutral) and Condition as a between-subject factor (control, imagery-misinformation, imagery-recognition). The analyses were conducted on the basis of the mean proportions of correct responses (correct and incorrect answers being complementary in the forced-choice recognition test). The analyses revealed a significant effect of Question type, $F(2, 234) = 37.47, p < .001, \eta^2_p = .24$. Post-hoc analyses (Bonferroni) showed that correct answers reached the lowest rates in the misleading condition ($M = .67; SD = .22$) compared to the neutral ($M = .84; SD = .18$) and consistent ($M = .86; SD = .18$) conditions, all $ps < .001$. Rates of correct answers were high and of equivalent magnitude in the neutral and consistent conditions, $p = 1.000$. These results replicated the misinformation effect reported in previous studies (see Mahé et al., 2015). However, there was neither a significant effect of Condition, $F(2, 117) = 0.05, p = .95$, nor a Condition x Question type interaction effect, $F(4, 234) = 0.98, p = .42$. Hence, there is no evidence that imaging instructions affect false memories in the misinformation paradigm, whereas it significantly reduced false memories in the DRM paradigm.

Bayesian analyses

A multilevel Bayesian logistic regression was fitted with Question type as a within-subject factor (consistent, misleading, neutral, respectively coded 1, -2 and 1 as a quadratic contrast) and Condition as a between-subject factor (control, imagery-misinformation, imagery-recognition, respectively coded 0, -1 and 1 as a linear contrast) as well as their interaction as fixed factors and varying intercepts for participants and items (words) in the model. The

dependent variable was the participants' response (0 for incorrect answers or 1 for correct answers, correct and incorrect answers being complementary in the forced-choice recognition test). Data analysis was performed with the brms R package (Bürkner, 2018). Dispersion of each participant's responses as a function of Item type and experimental Condition is depicted in Figure 2.

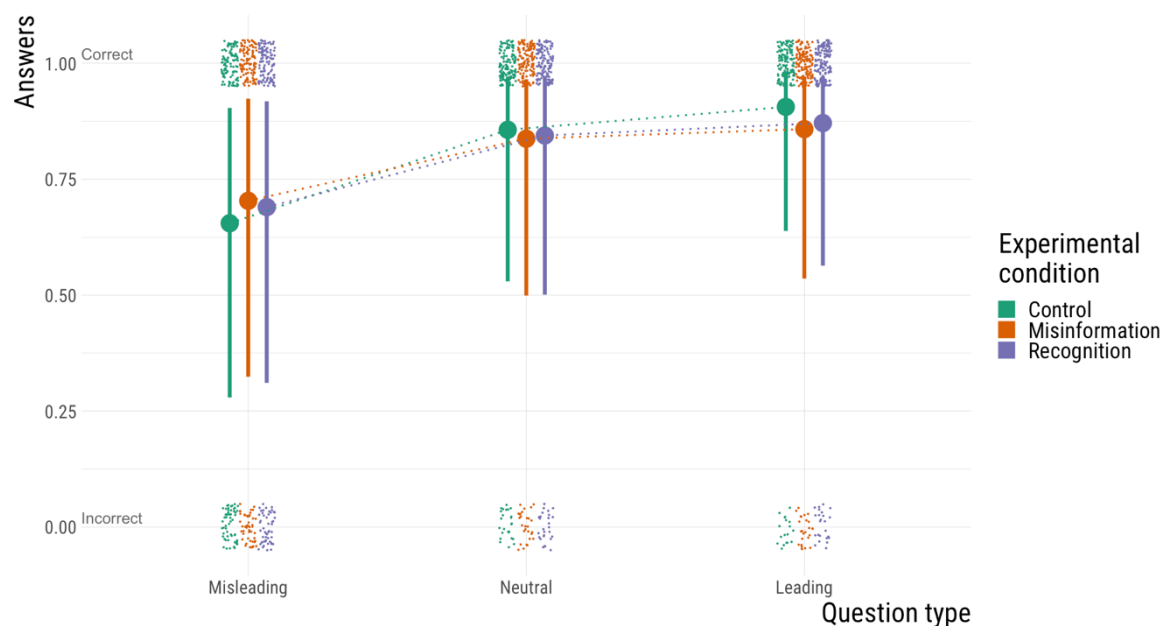


Figure 2. Answers as a function of Item type and experimental Condition.

Each small dot represents a participant's answer (the position of each dot is slightly modified for readability). Larger dots in the middle represent median estimates of response probability and are presented along with their 95% CI as estimated by the model.

The analyses revealed a substantial effect of Question type, $\beta = 0.35$, 95% CI [0.00, 0.69]. Correct answers reached the lowest rates in the misleading condition compared to the neutral and consistent conditions. When the question type variable was coded as a linear contrast (1, 0, -1), there was no evidence of an (absence of) effect of this variable, $\beta = 0.14$, 95% CI [-0.61, 0.90], suggesting that the quadratic contrast was the best model. There was no

evidence about a (absence of) Condition effect, $\beta = 0.01$, 95% CI [-0.16, 0.19], and neither of a Condition x Question type interaction effect, $\beta = 0.02$, 95% CI [-0.09, 0.13]. This was also true when the Question type variable and the Condition variable were coded as orthogonal contrasts (linear and quadratic respectively), with a $\beta = 0.02$, 95% CI [-0.09, 0.12] for the Condition effect and a $\beta = 0.04$, 95% CI [-0.09, 0.17] for the interaction effect.

2.1. Confidence in the answers

During the recognition test, participants estimated their level of confidence for each response on a five-point scale. Mean rates of confidence levels reported for correct answers are shown in Table 3. A 3*3 (Question type * Condition) mixed-design ANOVA computed on each participant's mean confidence rating reported for correct answers revealed neither a significant effect of Question type, $F(2, 230) = .44$, $p = .64$, nor of Condition, $F(2, 115) = .48$, $p = .62$. Moreover, the interaction between these two variables was not significant, $F(4, 230) = .58$, $p = .67$. For misleading questions, participants' confidence in misinformation should be heightened compared to the consistent or neutral questions, and therefore their confidence in the corresponding correct answers should be lower. Nevertheless, Pearson's correlation coefficients calculated between confidence scores for correct answers (total confidence rate scores observed for each participant) and the number of corresponding correct answers for each question type (consistent, misleading and neutral) were significant ($r = .662$; $r = .680$; $r = .658$, all $ps < .001$, respectively; analysis was run by eliminating participants with missing values, $N = 117$). These results indicate a high level of participants' confidence in their correct answers whatever the question type.

Table 3. *Mean confidence rates for correct answers (standard deviation) for each question type and condition in misinformation paradigm*

	Consistent question	Neutral question	Misleading question
All conditions	3.87 (0.81)	3.79 (0.74)	3.79 (0.99)
Control	3.85 (0.83)	3.79 (0.79)	3.78 (1.01)
Imagery-misinformation	4.04 (0.75)	3.87 (0.69)	3.76 (1.05)
Imagery-recognition	3.70 (0.84)	3.71 (0.74)	3.82 (0.93)

Discussion

This study aimed to test the effects of an imaging instruction on false memories in the DRM and the misinformation paradigms. While we know that false memories collected across these paradigms are not correlated, this study investigated whether modulators of false memories have a similar impact on both paradigms. Specifically, we expected to replicate previous results showing that imaging instructions during the encoding phase reduced the amount of false memories in the DRM. In the misinformation paradigm, we suggested that imaging instruction given during the misinformation questionnaire could amplify the real and plausible nature of the misleading suggestions. In addition, we suggested that imaging instruction given during the recognition task could reduce the suggestions' reliability, bringing better source discrimination as previously observed in DRM tasks. Therefore, the main question was whether, under certain circumstances, imaging instructions could affect false memories in these paradigms. This question was intended to provide further support in favor of the similarities or differences between these kinds of false memories, as some past findings have shown that they may rely on different mechanisms (Ost et al., 2013; Patihis et al., 2018; Zhu et al., 2013).

Our findings revealed false memory effects in the DRM and misinformation tasks, replicating previous studies (Roediger & McDermott, 1995; Loftus et al., 1978). In addition, the imaging instruction reduced DRM false memories, in line with past findings (e.g. Foley, 2012). In contrast, as the findings were not significant, there was no evidence that the imaging instruction affected false memories in the misinformation task. Although our experimental design (between-subject) did not allow us to compute correlations, our results were in accordance with past within-subject design studies (e.g. Ost et al., 2013). Indeed, the absence of relationship reported by Ost et al. is corroborated here by the fact that the impact of imagery manifested itself differently across the two paradigms, supporting the idea that the memory errors which they generate refer to false memories of a different nature.

Nevertheless, how can the lack of evidence regarding an imagery effect in the misinformation task be explained? Although we remain inconclusive, one explanation (which must be interpreted with caution) could be found from the way in which the imaging instruction was implemented in the study. It was explicitly induced at the DRM encoding phase and during post-encoding or the retrieval stages of the misinformation task. An imagery instruction during the encoding phase of the misinformation paradigm was not appropriate in this case because processing the video footage led to a visual processing. Therefore, according to the visual imagery approaches (Paivio, 1986), imaginal coding might be automatically and implicitly elicited by the visual processing of the video footage in the misinformation task. This hypothesis relies on false recognition rates that seem to be lower in the standard misinformation task compared to the standard DRM paradigm. Therefore, visual images corresponding to the video footage might provide a sufficiently distinctive cue to cause less misattribution between the original event and any misleading information (Israel & Schacter, 1997). Hence, the absence of evidence regarding the imaging instruction could result from visual processing leading to

more distinctive memory traces of the original event, supporting source monitoring. This hypothesis could also explain the absence of correlation between both paradigms.

This visual processing effect is in line with past studies showing a reduction of false recognitions when encoding conditions favor the processing of perceptual details like drawings (Israel & Schacter, 1997). In this view, the distinctive characteristics of the perceived events (e.g. video footage; drawings; visual images) may enable consistent memories to be distinguished from inaccurate ones, thus favoring the discrimination process during the recovery phase. In DRM tasks, semantic network activation and verbal coding lead to a semantic representation that is poor in distinctive details, the latter nonetheless proving useful for efficient source monitoring. In the misinformation paradigm, visual and verbal encoding lead to an episodic representation rich in distinctive details, increasing source monitoring efficiency (Zhu et al., 2013). In conclusion, the creation of false memories in each paradigm is likely to hinge on different processes. Therefore, false memories in the DRM may not predict memory distortions in the misinformation task. These conclusions are in line with James Ost's findings and past studies that found no reliable relationship between false memories in these two paradigms (Falzarano & Siedlecki, 2019; Nichols & Loftus, 2019).

This exploratory study may be considered as an extension of James Ost's conception of false memory paradigms, for which the only common mechanism between both paradigms would be the monitoring process. Ost et al. (2013) have discarded several explanations regarding the absence of relationship between these two paradigms, such as unreliable measurements of recognitions between each paradigm, sample differences, or lack of power. We may add that neither the interference effect between tasks performed by the same participants, nor the cognitive load resulting from successive tasks explained these differences. In our study, these effects were controlled with a between-subject design. Ost suggested (2013, p. 5) that DRM false memories result from an internal and implicit activation and a failure of

source monitoring increased by the presence of lures in the recognition test. The misinformation effect, in contrast, results from an external and explicit misleading suggestion (post-encoding event). In addition, the stimuli's nature may also affect the encoding process and, a fortiori, the role of visual imaging in these paradigms, hence the consequences on the monitoring processes. In the DRM, false memories are based on semantic associations of verbal stimuli and implicit activation mechanisms. In contrast, misinformation relies on visual and verbal stimuli and recollection processes in episodic memory, i.e. explicit mechanisms. All these variables could explain the differences between such paradigms and should be tested in further experiments.

Our study has some limitations: the between-subject design precluded the analyses on the relationships between both paradigms. Nonetheless, a within-subject design has the inconvenience that imaging instructions in a given task may contaminate the subsequent task. It remains that this pilot study was crucial for establishing statistical models by shedding light on the data patterns in these paradigms. Considering these limitations, further research will be needed.

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Total: 5 924 words

Compliance with Ethical Standards

The data has not been previously published, and it is not under simultaneous consideration by another journal. Research ethics were applied in accordance with the APA’s ethical standards. My coauthors and I do not have any interests that might be interpreted as influencing the research. Participants were fully informed of the current research, freely consented to participate and were able to withdraw whenever they wished.

Open Practices

Data (for frequentist and Bayesian analyses) and scripts for the Bayesian analyses have been made publicly available via the Open Science Framework and can be accessed at <https://osf.io/zsh3b/>.

