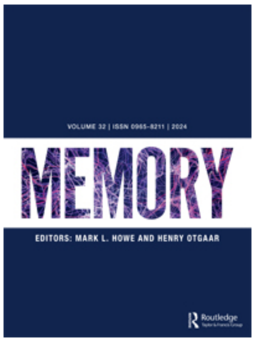

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Misinformation in social interaction: examining the role of discussion

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ABSTRACT

Memory is a reconstructive process that is prone to intrusions and distortions. These processes can be amplified by the emergence and propagation of false information in the social environment. While the acceptance of misinformation is well documented in individual memory tasks, the production of false memories in social interaction contexts presents mixed findings. One factor that may contribute to these inconsistencies is the collaboration method used, which may vary in the opportunities they offer for more (free-for-all) or less (turn-taking) discussion. The current study contrasts these two collaboration methods in misinformation acceptance. Participants watched a video, followed by an individual recall task. Then, they completed a questionnaire containing true and misinformation about the video, individually or in pairs (using free-for-all or turn-taking methods). Finally, participants were given a new individual recall task. Results revealed that participants responding to the questionnaire using the free-for-all method were more accurate and accepted less misinformation (vs. turn-taking and individual conditions). Critically, in the second individual recall, these participants also recalled less misinformation from the questionnaire than those in the turn-taking condition. These results suggest that discussion opportunities during social interaction enhance correction and error-pruning and reduce misinformation acceptance.

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Misinformation; free-for-all method; turn-taking-method; error-pruning; social interaction contexts

Memory is a reconstructive process prone to errors and distortions (Maswood & Rajaram, 2019). This malleability often leads people to recall incorrect details or even retrieve entirely fabricated information, producing false memories (e.g., Maswood & Rajaram, 2019; Roediger & McDermott, 1995).

The most common paradigms used to study false memories are the Deese-Roediger-McDermott (DRM; Deese, 1959; Roediger & McDermott, 1995) and the misinformation paradigm (Loftus & Palmer, 1974). The DRM consists of presenting a list of words semantically associated with another word that is never presented - critical lure. The results of hundreds of studies using the DRM have shown that participants often recall/recognize the critical lure as part of the list of words presented initially. The misinformation paradigm rests on distorting memory for already encoded information by introducing misinformation (Loftus & Palmer, 1974). The typical procedure consists of presenting a video or image and subsequently introducing misinformation about the initially encoded event via a questionnaire or narrative. When asked to remember as much information as possible about the initial event, participants tend to retrieve the misinformation introduced by the questionnaire/narrative as part of the originally presented event.

Notably, the nature of the false memories produced in these two paradigms is different. In the DRM, false memories are generated spontaneously through internal processes of semantic activation of the critical lure (e.g., Otgaar & Candel, 2011). In the misinformation paradigm, false memories result from an external suggestion, that is, they are based on post-event misinformation that is misattributed to the original event (e.g., Loftus, 2005; Otgaar et al., 2010). Despite these differences, the production of false memories in these two paradigms is often explained by the same account – the source-monitoring framework (Johnson et al., 1993; Roediger et al., 2001; but see Ayers & Reder, 1998; Brainerd & Reyna, 1998 for alternative accounts). According to this framework, false memories result from a failure to monitor the source of false information. That is, people attribute the origin of false information to the initially presented event/information. In the case of the DRM, the source of the critical lure is wrongly attributed to the initial word list, whereas in the misinformation paradigm, the false information is erroneously attributed to the original event instead of the

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subsequent questionnaire/narrative (Johnson et al., 1993; Roediger et al., 2001).

The production of false memories and its underlying cognitive mechanisms are well established in individual memory tasks. However, memory is a social and cooperative activity since encoding and recall often occur in social interaction contexts (e.g., Garcia-Marques et al., 2012; Garrido et al., 2012; Maswood & Rajaram, 2019). The mechanisms underlying the production of false memories in social interaction contexts have been typically studied using social contagion (Meade & Roediger, 2002; Roediger et al., 2001) and collaborative memory (Weldon & Bellinger, 1997) paradigms. The social contagion paradigm consists of presenting a set of stimuli (e.g., household pictures, lists of words), followed by a retrieval task during which misinformation is introduced by a social source (e.g., confederate). The task ends with an individual memory test for the initially presented information. The results consistently show that part of the misinformation introduced by the confederate is retrieved in the final memory task (e.g., Meade & Roediger, 2002). In the collaborative memory paradigm, participants read or hear a list of stimuli (e.g., words) and then recall it in a collaborative group (of two or more participants). The results converge in showing that while collaborative group performance is higher than that of an individual alone, collaborative groups' recall is lower than that of nominal groups (composed of as many members as those that constitute the collaborative group, remembering the information individually). This counterintuitive effect, known as collaborative inhibition (Weldon & Bellinger, 1997), results from exposure to the information retrieved by the other group members, which disrupts the individual retrieval strategies (Basden et al., 1997a; see Barber et al., 2015; Diehl & Stroebe, 1987, for alternative accounts).

The production of false memories in collaborative memory tasks presents mixed results. Some studies using the DRM paradigm have concluded that collaborative groups produce more false memories than nominal groups (Thorley & Dewhurst, 2007), while others report the opposite pattern (Saraiva et al., 2017). Still, other studies reported the absence of significant differences between nominal and collaborative groups in producing false memories for the critical lure (Basden et al., 1997b). These inconsistencies may result from the collaboration method used (e.g., Maswood et al., 2022; Thorley & Dewhurst, 2007; for a review, see Maswood & Rajaram, 2019).

Notably, the interaction between the different group members can be more, or less restricted, according to the collaboration method used: turn-taking or free-for-all, respectively. In turn-taking, this interaction is limited, and information is recalled in turns. Specifically, each participant recalls an item and gives the turn to the next participant who should recall another item, and so on (Basden et al., 1997a; Basden et al., 1997b; Thorley & Dewhurst, 2007). Discussion between group members is not allowed, and the task ends after a few attempts in which none of the participants can recall more information (e.g., Marion & Thorley, 2016; Maswood et al., 2022; Saraiva et al., 2017; Thorley & Dewhurst, 2007; Weldon & Bellinger, 1997). In the free-for-all method, no specific instructions are given on how group members should collaborate, and discussion is allowed. If disagreements arise, participants must discuss and reach a consensus. The task ends when participants cannot recall more information (e.g., Harris et al., 2012; Marion & Thorley, 2016; Maswood et al., 2022; Maswood & Rajaram, 2019; Vredeveldt et al., 2017).

These methods result in different interaction dynamics, which affect the amount and type of information retrieved (for reviews, see Marion & Thorley, 2016; Maswood & Rajaram, 2019). The opportunities for discussion allowed in the free-for-all method allegedly promote corrective feedback and error pruning, which should decrease the errors (Maki et al., 2008; Maswood & Rajaram, 2019). The turn-taking method limits the interaction between group members, the opportunity for discussion, and correction of erroneous information introduced during the recall, increasing error production (e.g., Harris et al., 2012; Maswood et al., 2022; Vredeveldt et al., 2017). The differences in error production observed with the different methods have also been explained by the retrieval criteria they prompt (e.g., Basden et al., 1997b; Thorley & Dewhurst, 2007). According to this explanation, in the free-for-all method, the pressure to recall is low, promoting the adoption of a conservative retrieval criterion that reduces errors. In contrast, in the turn-taking method, the pressure to recall is high (i.e., the participant must recall an item on their turn), promoting the use of a lax retrieval criterion, which might favour error production (for a review, see Maswood & Rajaram, 2019).

The impact of the collaborative method on the production of false memories has already been investigated in two studies using the DRM paradigm. Thorley and Dewhurst (2007) compared the performance of collaborative groups of variable size with that of nominal groups in a recall task. Participants were exposed to DRM lists, and after a filler task, they were asked to recall as many words as they remembered, individually or in collaboration. Half of the collaborative groups recalled information using the turn-taking method, and the other half used the free-for-all method. Finally, all participants performed an individual recall task. The results revealed that groups using the turn-taking method in the first recall task produced more false memories than free-for-all and nominal groups. In the final individual recall, participants in the turn-taking condition produced a level of false memories equivalent to the first recall, while for those in free-for-all conditions, that level dropped. Following a similar procedure, Maswood et al. (2022) recently compared the performance of triads using turn-taking, free-for-all, and nominal groups. The results of the first recall task replicated those observed by Thorley and Dewhurst (2007). In the final individual recall, participants who had collaborated before (turn-taking and free-for-all, although slightly higher in the turn-taking condition) produced more false memories than those who performed all tasks individually.

According to Thorley and Dewhurst (2007), these results suggest that the turn-taking method enhances false memories due to the pressure imposed during collaborative recall. Participants performing the tasks individually (i.e., not engaging in social interaction) are not subject to this pressure to contribute to group recall, which results in fewer false memories (Basden et al., 1997b; Thorley & Dewhurst, 2007). Maswood and Rajaram (2019) further suggested that the lower production of false memories observed in the free-for-all collaborative condition could be explained by error detection and correction opportunities offered in this collaboration method, which are limited in the turn-taking condition. In both studies, the production of false memories in an individual post-collaborative recall suggests the existence of social contagion (i.e., memory distortion resulting from the introduction of false information by social sources; Meade & Roediger, 2002; Roediger et al., 2001) for individuals in collaborative conditions, particularly when using the turn-taking method (Maswood et al., 2022; Thorley & Dewhurst, 2007).

The impact of collaboration on the emergence of false memories has also been studied using the misinformation paradigm. Likewise, the observed results have been mixed. For example, Karns et al. (2009) showed participants a video about a car accident and then asked them to read a narrative with or without misinformation (between-subjects manipulation). Then, participants answered a questionnaire about the video, individually or in dyads (using the free-for-all method). The misinformation effect was lower in participants collaborating during the questionnaire. In another study (Rivardo et al., 2013), after watching a video of a car accident, participants read an accurate or inaccurate narrative about the accident (between-subjects manipulation). Afterward, they answered a questionnaire (Moment 1), individually or in collaborative pairs (using the free-for-all method). Participants individually answered the questionnaire again a few minutes (Moment 2) and a week later (Moment 3). At Moment 3, participants who completed the questionnaire collaboratively at Moment 1, reported more misinformation than those who always answered individually. These results suggest that previous collaboration increases the misinformation effect in a subsequent individual task. Recently, Rossi-Arnaud et al. (2020) and Saraiva et al. (2021) concluded that the free-for-all method could reduce the misinformation effect, supporting the results previously found by Karns et al. (2009). In Rossi-Arnaud et al. (2020), participants watched a bank robbery video followed by an immediate free recall task performed individually or in collaborative pairs. Then, they answered a questionnaire (individually or in collaboration) containing correct and false information about the video. Participants were then asked to return to the laboratory after one hour (Experiment 1) or one week (Experiment 2). In this second phase, participants performed a recognition task (answering yes/no to a set of true and false statements about the video) individually or collaboratively. In both experiments, participants who collaborated during the questionnaire were less likely to provide false assents to false statements in the recognition task. In a similar paradigm, Saraiva et al. (2021) also presented a video about a bank robbery, followed by a free recall task, a questionnaire containing correct and false information about the video, and a final free recall. In Experiment 1, half of the participants performed all tasks collaboratively and the other half individually, while in Experiment 2, the collaborative manipulation only occurred during the questionnaire. The results of both experiments revealed that participants who collaborated during the questionnaire accepted less false information as being correct. Notably, in the subsequent recall task (collaborative or individual), they also recalled less misinformation.

While studies with the DRM paradigm suggest that the two collaboration methods shape the production of false memories differently, this selective influence has never been examined in the misinformation paradigm. To our knowledge, previous studies have always resorted to the free-for-all method.

The present study examines the role of the collaboration method (turn-taking and free-for-all methods) in the acceptance/rejection of false information using the misinformation paradigm. The collaborative manipulation was introduced during the questionnaire[1], with one-third of the participants answering the questionnaire using the turn-taking method, another third using the free-for-all method, and the remaining participants responding individually. All participants performed two individual recall tasks: one before and the other after answering the questionnaire.

Based on previous studies comparing different collaborative methods (e.g., Maswood & Rajaram, 2019; Thorley & Dewhurst, 2007), although using a different paradigm, we expected participants in the free-for-all condition to accept less misinformation during the questionnaire than those in the turn-taking condition. Introducing an individual condition might also inform whether free-for-all collaboration decreases misinformation acceptance or turn-taking collaboration increases its acceptance. Moreover, this condition could also provide some hints on the mechanisms underlying the effects. If misinformation acceptance is minimised due to correction processes occurring during discussion, this acceptance should be lower in free-for-all conditions than in turn-taking and individual conditions. If turn-taking enhances errors due to higher pressure and the adoption of a less conservative criterion, the acceptance of false information is expected to be higher in the turn-taking condition compared to free-for-all and individual conditions.

Further, in the second recall, participants from the three conditions should recall some of the false information from the questionnaire, reflecting memory susceptibility to integrating (mis)information introduced after the encoding of the original event. Still, we expected that participants in the free-for-all condition would recall less misinformation from the questionnaire due to the detection and correction processes occurring during collaboration. Notably, in the absence of such correction opportunities, participants using the turn-taking method during the questionnaire were expected to recall more misinformation from the questionnaire in the second individual recall task.

Method

Participants

A sample of 156 pairs was determined by a priori power analysis (G*Power) using as reference the effect size reported by Saraiva et al. (2021; Experiment 2) ($\eta_p^2 = .06$) and a power $1 - \beta = 0.80$ to detect the interaction between Condition (Individual vs. Free-for-all vs. Turn-taking) and Accepted Information (Misinformation vs. Correct; within-participants).

The final sample consisted of 312 participants who received a gift card for their participation ($M_{age} = 22.25$; $SD = 6.81$; 262 female). One-third of the participants answered the questionnaire using the turn-taking method ($N = 52$ pairs), another third using the free for-all-method ($N = 52$ pairs), and the remaining, individually ($N = 104$ participants).

Materials and design

We used a 3-minute mute video about a bank robbery with no signs of violence (Herrington, 2002). The questionnaire, adapted from Luna and Migueles (2008, 2009), consisted of 32 statements. Half of the statements contained true information (i.e., information presented in the video; e.g., "The thief's car was blue" - and it was), and the remaining 16 contained false information (i.e., information not presented/distorted about the video; e.g., "The thief was wearing sports shoes" - the thief was wearing boots).

Procedure

The study was approved by the ethics board of the host institution (Ref: I-097-12-22). Prior to data collection, sample size, manipulated variables, hypotheses, and planned analyses were preregistered on AsPredicted (https://aspredicted.org/7S9_KFS).

Participants arrived at the lab to participate in a study on how people process information, without any reference to false memories. Written informed consent was obtained from all participants.

Participants sat in front of a 17-inch monitor connected to a networked computer and were told they would watch a video, to which they should pay as much attention as possible, as they would later have to remember it. The sessions were conducted in pairs or individually according to the condition. After a 2-minute distracting word search task, participants completed an individual recall task, in which they were asked to write down as much information (e.g., people, objects, actions) that they remembered from the video. The task ended when participants could not recall more information.[2] Then, according to the experimental condition, participants answered a questionnaire individually or collaboratively (using the turn-taking or free-for-all method). Participants' task consisted of deciding whether each statement was true or false. In the two collaborative conditions, each group member was given a questionnaire.[3] In the turn-taking condition, one of the participants (randomly selected) was asked to answer the first question aloud. Then, the other participant answered the next question, and so on. Participants were not allowed to discuss or comment on the statements, and they had to write down all the answers (their own and those of the other group member). In the free-for-all condition, participants were instructed to discuss and reach a consensus regarding the answer to each question. Participants in the individual condition completed the questionnaire individually.

After the questionnaire, participants were given a new distracting task (similar to the previous one). Then, they were asked to complete a second individual recall task in which they were instructed to write down as much information as they remembered from the original event. At the end of the experiment, which lasted approximately 40 min, participants were thanked and debriefed.

Results

Data analysis strategy

The information recalled in the two free recall tasks was coded as correct if it corresponded to the items of a list of 132 information units containing actions, objects, and other details about the video (see Paulo et al., 2015; Saraiva et al., 2021, for similar procedures). The proportion of correct recall was calculated based on the number of correct information units divided by the 132 possible information units. In the second recall task, we also calculated the proportion of correct information (maximum = 16) but also misinformation (maximum = 16) introduced by the questionnaire. If any of the items presented in the questionnaire (correct or false) had already been recalled in the first recall task, those items were discounted in calculating the proportion of accepted information.[4] Recall data were analyzed at the individual level (104 participants per condition).

The overall number of correct responses to the questionnaire (hits) (i.e., to consider that a statement is true when presented in the video and that a statement is false when not presented in the video) was analyzed. We also separately analyzed the acceptance of correct information (i.e., true response for information presented in the video) and misinformation (i.e., true response for information not presented in the video) during the questionnaire. In collaborative conditions, the unit of analysis in the questionnaire was the group (52 free-for-all groups and 52 turn-taking groups). In individual conditions, we used the responses of the 104 participants. Additionally, we also analyzed nominal group performance. To this end, we randomly grouped the 104 participants from the individual condition in pairs (52 nominal groups). After excluding redundant responses in each pair, we summed the responses of all pairs.

The data were analyzed using IBM SPSS V28, and the raw data used in the reported analyses are available at OSF (https://osf.io/ym3kr/?view_only = 9e51b04eefa14e00a46936632935a709).

Recall 1

As expected, a one-way ANOVA did not show significant differences between the three experimental conditions ($M_{Ind} = .25$, $SD = .08$; $M_{F4A} = .23$, $SD = .07$; $M_{TT} = .24$, $SD = .07$) in the proportion of information recalled about the video, $F(2,309) = 0.83$, $p = .437$, $\eta p^2 = .005$, 95% CI [.00, .03].

Questionnaire

The number of hits varied significantly between experimental conditions, $F(2,205) = 9.77$, $p < .001$, $\eta p^2 = .087$, 95% CI [.02, .16]. Participants who collaborated using the free-for-all method ($M = 23.35$, $SD = 2.33$) were significantly more accurate than those who collaborated using the turn-taking method ($M = 21.15$, $SD = 2.84$, $p < .001$), and those who completed the questionnaire individually ($M = 21.69$, $SD = 2.77$, $p = .001$). The difference between participants in these last two conditions was not significant ($p = .719$).

As for the acceptance of correct information and misinformation (see Table 1), a 3 (Condition: Individual vs. Free-for-all vs. Turn-taking) X 2 (Type of information accepted: Correct vs. Misinformation) mixed ANOVA revealed that correct information was significantly more accepted than misinformation, $F(1,205) = 953.08$, $p < .001$, $\eta p^2 = .823$, 95% CI [.78, .85]. The main effect of condition was not significant, $F(2,205) = 1.32$, $p = .271$, $\eta p^2 = .013$, 95% CI [.00,.05], but the Condition X Type of accepted information interaction was, $F(2,205) = 9.77$, $p < .001$, $\eta p^2 = .087$, 95% CI [.02, .16]. Pairwise comparisons with Bonferroni correction showed that the acceptance of correct information did not differ between the three conditions (all $ps \geq .102$). However, participants in the free-for-all condition accepted less misinformation than those who collaborated using the turn-taking method ($p = .001$) and those who responded to the questionnaire individually ($p = .006$). The difference between turn-taking and individual conditions was not significant ($p = .845$).

Table 1. Correct and false information accepted during the questionnaire.

Condition	Correct information accepted *M* (SD)	Misinformation accepted *M* (SD)
Free-for-all	13.13 (1.52)	5.78 (2.03)
Individual	12.60 (1.63)	6.90 (2.11)
Turn-taking	12.44 (1.80)	7.29 (2.14)
Total	12.69 (1.67)	6.72 (2.16)

Questionnaire performance using nominal groups

We repeated the analysis using nominal groups as individual and nominal scores might reveal very different information. The number of hits varied across experimental conditions, $F(2,153) = 112.46$, $p < .001$, $\eta p^2 = .595$, 95% CI [.49, .66]. Participants in the nominal group ($M = 27.87$, $SD = 1.65$) were significantly more accurate than those who collaborated using the turn-taking ($M = 21.15$, $SD = 2.84$, $p < .001$), and the free-for-all method ($M = 23.35$, $SD = 2.33$, $p < .001$).

A 3 (Condition: Nominal vs. Free-for-all vs. Turn-taking) X 2 (Type of information accepted: Correct vs. Misinformation) mixed ANOVA revealed a significant main effect of the type of information accepted, $F(1,153) = 879.40$, $p < .001$, $\eta p^2 = .852$, 95% CI [.81, .88], indicating that correct information ($M = 13.56$, $SD = 1.87$) was significantly more accepted than misinformation ($M = 7.89$, $SD = 2.79$). The main effect of condition was also significant, $F(2,153) = 112.00$, $p < .001$, $\eta p^2 = .594$, 95% CI [.49, .66]. Pairwise comparisons revealed that nominal groups ($M = 12.85$, $SD = 1.35$) accepted more information than those in the turn-taking ($M = 9.87$, $SD = 1.97$; $p < .001$) and free-for-all conditions ($M = 9.46$, $SD = 1.78$; $p < .001$). The difference between both collaborative conditions was not significant ($p = .312$). Finally, the interaction Condition X Type of information accepted was significant, $F(2,153) = 20.29$, $p < .001$, $\eta p^2 = .210$, 95% CI [.10, .31]. Participants in nominal groups accepted more correct information ($M = 15.10$, $SD = 1.07$) than those in the two collaborative conditions (see Table 1; p's $< .001$). Participants in the two collaborative conditions did not differ significantly in accepting correct information ($p = .06$). Likewise, participants in nominal groups accepted more misinformation ($M = 10.60$, $SD = 1.62$) than those in the free-for-all (see Table 1; $p < .001$) and in the turn-taking (see Table 1; $p < .001$) conditions. Participants in the free-for-all condition accepted less misinformation than those who collaborated using the turn-taking method (see Table 1; $p < .001$).

Recall 2

The proportion of correct information recalled from the original event varied significantly between conditions, $F(2,309) = 8.09$, $p < .001$, $\eta p^2 = .050$, 95% CI [.01, .10]. Participants in collaborative conditions recalled significantly more correct information about the video ($M_{F4A} = .29$, $SD = .08$; $M_{TT} = .29$, $SD = .08$) than participants in the individual condition ($M = .25$, $SD = .07$; all $ps \leq .002$). The difference between the two collaborative conditions was not significant ($p = 1.00$).

To compare the proportion of video information correctly recalled in each condition across the two recall tasks, we conducted a 3 (Condition: Individual vs. Free-for-all vs. Turn-taking) X 2 (Recall task: Recall 1 vs. Recall 2) mixed ANOVA (see Table 2). The results revealed that overall, participants recalled more correct information from the original event in the second recall task than in the first, $F(1,309) = 120.14$, $p < .001$, $\eta p^2 = .280$, 95% CI [.20, .36]. The main effect of Condition was not significant, $F(2,309) = 1.62$, $p = .201$, $\eta p^2 = .010$, 95% CI [.00, .03], but the interaction Condition X Recall task was, $F(2,309) = 20.88$, $p < .001$, $\eta p^2 = .119$, 95% CI [.06, .19]. Pairwise comparisons with Bonferroni correction showed that participants who collaborated during the questionnaire recalled more information in Recall 2 than in Recall 1 (p's $< .001$). This difference was not significant for participants in the individual condition ($p = .27$).

Recall of correct information and misinformation presented in the questionnaire

We conducted a 3 (Condition: Individual vs. Free-for-all vs. Turn-taking) × 2 (Type of recalled information: Correct vs. Misinformation) mixed ANOVA to examine the proportion of information (correct and misinformation) recalled from the questionnaire.

A significant main effect of the type of information recalled, $F(1,309) = 527.05$, $p < .001$, $\eta p^2 = .630$, 95% CI [.57, .68], indicated that participants recalled more correct information ($M = .24$, $SD = .14$) than misinformation from the questionnaire ($M = .06$, $SD = .07$). The main effect of condition was not significant, $F(2,309) = 2.64$, $p = .073$, $\eta p^2 = .017$, 95% CI [.00, .05], but the interaction between condition and type of information was, $F(2,309) = 7.74$, $p < .001$, $\eta p^2 = .048$, 95% CI [.01, .10]. Overall (see Figure 1), participants in the free-for-all condition were those who recalled more correct information ($M_{F4A} = .26$, $SD = .13$) and less misinformation from the questionnaire ($M = .04$, $SD = .05$). Specifically, participants in this condition recalled more correct information that those in the individual condition ($M = .21$, $SD = .13$; $p = .021$). The difference between free-for-all and turn-taking ($M = .25$, $SD = .16$) and turn-taking and individual conditions were not significant (p's $\geq .117$). Participants in the free-for-all condition recalled less misinformation than those in the turn-taking condition ($M = .08$, $SD = .08$, $p < .001$). The difference between free-for-all and individual ($M = .06$, $SD = .07$) and turn-taking and individual conditions were not significant (p's $\geq .078$).

Table 2. Proportion of video information correctly recalled in Recall 1 and 2.

Condition	Recall 1 *M* (SD)	Recall 2 *M* (SD)
Free-for-all	.23 (.07)	.29 (.08)
Individual	.25 (.08)	.25 (.07)
Turn-taking	.24 (.07)	.29 (.08)
Total	.24 (.07)	.28 (.08)

Social contagion in the turn-taking condition

To examine social contagion, we analyzed the proportion of correct information and misinformation recalled that had been accepted during the questionnaire by the other group member. This analysis was only conducted for participants in the turn-taking condition since, in the free-for-all condition, both participants had to reach a consensus on the answer to each item.

The results showed that participants recalled similar proportions of misinformation previously accepted by themselves ($M = .22$, $SD = .36$) or by the other member of the group ($M = .23$, $SD = .36$), $t(104) = -.116$, $p = .908$, $d' = .011$, 95% CI [-.18, .20]. The same pattern of results was found for the recall of correct information ($M_{Self} = .41$, $SD = .31$; $M_{Other} = .40$, $SD = .31$), $t(104) = .188$, $p = .851$, $d' = .018$, 95% CI [-.17, .21].

Discussion

Memory is a reconstructive cognitive process prone to distortion and false memories (e.g., Bartlett, 1932; Maswood & Rajaram, 2019). These processes can be enhanced by false information circulating in the social environment with important individual and social consequences (Maswood & Rajaram, 2019). Nevertheless, the existent studies on the production of false memories in social interaction contexts show mixed results (e.g., Karns et al., 2009; Rivardo et al., 2013; Saraiva et al., 2021; Thorley & Dewhurst, 2007). Previous studies using the DRM paradigm revealed that the production of false memories depends on the collaboration method used (Maswood et al., 2022; Thorley & Dewhurst, 2007). While in the free-for-all method, group members interact and discuss the information, which favours error detection and correction, the limited interaction in the turn-taking method does not offer error pruning opportunities, enhancing the production of errors (e.g., Maswood & Rajaram, 2019). Moreover, other authors (e.g., Thorley & Dewhurst, 2007) suggest that the higher error production observed in turn-taking conditions might result from the adoption of a laxer criterion because of the greater pressure to contribute to the recall.

However, the influence of the collaboration method has never been examined using the misinformation paradigm. To address this gap, the present study analyzed the role of the collaboration method (free-for-all and turn-taking) in the acceptance of false information using the misinformation paradigm.

As expected, participants did not differ in the proportion of information recalled in the first recall task, which occurred before any experimental manipulation. In the second recall task, participants who collaborated during the questionnaire (free-for-all and turn-taking)

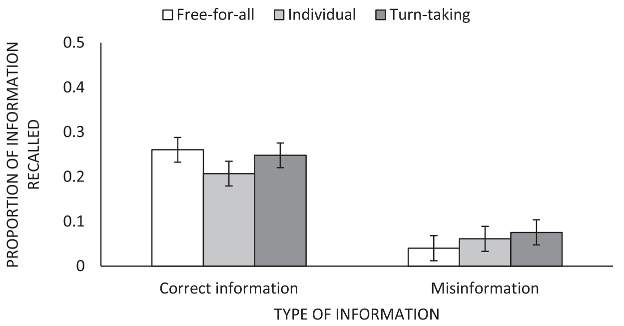

Figure 1. Proportion of correct and false information from the questionnaire in Recall 2.

recalled more information from the video than participants in the individual condition. Additionally, these participants also significantly increased their recall from the first to the second recall task, while those in the individual condition maintained their performance level across memory tasks. In all conditions, participants were re-exposed to part of the information from the original event during the questionnaire, which offers a second opportunity to study the material to be remembered (e.g., Blumen & Rajaram, 2008; Rajaram & Pereira-Pasarin, 2010). This re-exposure might have led participants to remember more information in Recall 2. While recall gains from Recall 1 to Recall 2 could be expected in all conditions as a result of exposure to correct information during the questionnaire or of repeated recall (hypermnesia; e.g., Erdelyi & Kleinbard, 1978), this was only observed in collaborative conditions. Notably, during the questionnaire, only participants in collaborative conditions were exposed to the responses given by the other participant. Therefore, the observed post-collaborative advantage (e.g., Blumen & Rajaram, 2008) seems to have emerged essentially from collaboration. These results also replicate those reported by Saraiva et al. (2021) and corroborate the idea that collaboration during encoding is beneficial for subsequent individual recall tasks.

Notably, during the questionnaire, participants in the free-for-all condition were more accurate in their answers (i.e., hits) than participants in the other conditions. These participants accepted more correct information (although the difference was not significant from the remaining conditions) and less misinformation than those in the other two conditions. When the individual performance was combined into nominal groups, accuracy, correct information, and misinformation acceptance during the questionnaire were higher than in collaborative conditions. This pattern of results confirms that collaborative groups do not achieve the performance of pooled individuals (i.e., nominal groups; e.g., Andersson & Rönnberg, 1996). Regardless of the unit of analysis used (individual or nominal), our results seem to converge in showing that the free-for-all method reduces the acceptance of misinformation. Moreover, while the current design does not constitute a strict test of the underlying mechanisms of these effects, the results seem to align with previous studies suggesting that the opportunities for discussion and error pruning offered by the free-for-all-method enhance misinformation rejection (e.g., Karns et al., 2009; Maki et al., 2008; Rossi-Arnaud et al., 2020; Saraiva et al., 2021; see Maswood & Rajaram, 2019 for a review).

In the second recall task, participants in the free-for-all condition recalled less misinformation from the questionnaire than those in turn-taking conditions. As previously noted, these participants were those that, overall, accepted less misinformation during the questionnaire, an advantage that carried over to the subsequent individual recall task. In contrast, participants in the turn-taking condition recalled more misinformation than those in free-for-all conditions, replicating the pattern observed in the acceptance of misinformation during the questionnaire.

Taken together, these results suggest that the discussion and error pruning opportunities offered by the free-for-all method (e.g., Maki et al., 2008; Maswood & Rajaram, 2019; Rajaram & Pereira-Pasarin, 2010; Weigold et al., 2014), decrease the recall of misinformation in a subsequent individual recall task. Notably, we also observed that members of the same free-for-all collaborative group accepting misinformation items during the questionnaire, albeit residually, individually recalled some of those items ($M = .025$, $SD = .07$). This might suggest that while in free-for-all groups, errors (misinformation acceptance) are reduced; when errors go unchecked, they may be at the core of emerging collective false memories (e.g., Congleton & Rajaram, 2014; Greeley & Rajaram, 2023).

While the acceptance and recall of misinformation seem to descriptively decrease from free-for-all to turn-taking, with individual recall in between, the obtained results are not sufficient to establish a linear trend. In other words, we did not find compelling evidence that interaction with turn-taking enhances higher acceptance and recall of misinformation than individual conditions, in line with the criterion shift argument.

In all conditions, participants remembered some of the misinformation introduced in the questionnaire in the final recall task, replicating the misinformation effect (Loftus & Palmer, 1974). This effect has typically been explained by a failure to monitor the source of the misinformation, which is wrongly attributed to the original event rather than the questionnaire - the source monitoring framework (Johnson et al., 1993). Our results suggest that failures in source monitoring occur to a different extent in the different experimental conditions since participants in the free-for-all condition recalled less misinformation. However, our procedure does not allow us to examine possible differences between conditions in the source monitoring process. For this reason, future studies should include a source monitoring task of misinformation after the second recall to better understand this process. A previous study (Jalbert et al., 2021), including a source monitoring task after collaborative recall (free-for-all method), reported a false consensus effect for information discussed during collaboration. That is, participants considered that the information recalled by their collaborative partner was actually part of their own memory and that their own individual memories were shared by the group. However, to our knowledge, this task has never been applied to the misinformation paradigm in social interaction contexts or after using the turn-taking method.

Our study included an individual recall task between the video presentation and the questionnaire to establish whether the information recalled in the second recall task was encoded after the original event or acquired during collaboration (see Saraiva et al., 2021 for a similar procedure). However, this recall task may have decreased participants' susceptibility to accept misinformation introduced in the questionnaire by consolidating their memory for the original event (e.g., Hupbach et al., 2007), thus reducing the observed misinformation effect. However, this interpretation contrasts with recent studies showing the malleability of memory in incorporating new information following retrieval (e.g., Carneiro et al., 2021). In line with a memory updating after retrieval framework (MUAR; Finn, 2017), this research suggests that retrieval facilitates the incorporation of new, related information, regardless of its correct or false nature. To disentangle the role of Recall 1 in the integration of subsequent misinformation into memory, future studies should replicate this procedure without the initial recall task to test the extent to which performing a retrieval task prior to exposure to misinformation affects the size of the misinformation effect.

We also examined whether participants in the turn-taking condition were more likely to integrate into their memory, information (correct and false) that was accepted during the questionnaire by themselves or by the other group member. The results did not show significant differences, suggesting that participants rely to the same extent on information (correct and false) accepted by themselves or by their interaction partners, supporting the social contagion of memory (Meade & Roediger, 2002; Roediger et al., 2001). Future studies using this paradigm could directly examine social contagion in free-for-all conditions.

To our knowledge, this study represents the first attempt to compare two collaboration methods using the misinformation paradigm. The comparison of our results with previous studies is limited since the studies using the turn-taking method typically resort to the DRM paradigm (e.g., Basden et al., 1997b; Maswood et al., 2022; Thorley & Dewhurst, 2007), and studies using the free-for-all method resort to the misinformation paradigm (e.g., Karns et al., 2009; Rivardo et al., 2013; Saraiva et al., 2021). Still, our results overall support the turn-taking findings reported in DRM studies and the free-for-all findings reported in studies using the misinformation paradigm.

The growing transmission of misinformation we are currently witnessing has important individual and social consequences. Thus, examining the mechanisms underlying its emergence and transmission becomes crucial, especially in social interaction contexts where this type of information circulates more quickly (e.g., social networks). Social media are nowadays privileged communication channels, enabling the transmission of correct information but also of misinformation. Previous studies have already extended collaborative memory paradigms to online contexts (Ekeocha & Brennan, 2008; Hinds & Payne, 2016, 2018; Rossi-Arnaud et al., 2023). However, these efforts have mainly focused on the effects of collaboration in recalling true information (except Rossi-Arnaud et al., 2023, using the DRM paradigm) and in free-for-all conditions. As some authors pointed out, social media platforms can vary in the nature of the interaction they allow their users (e.g., Maswood & Rajaram, 2019; Maswood & Rajaram, 2019). While some platforms allow interaction (e.g., WhatsApp, Facebook Messenger), which might promote error correction and protection, others restrict interaction (e.g., websites, blogs), favouring contexts where errors/false information can go uncorrected (Maswood & Rajaram, 2019). For this reason, the role of discussion in rejecting misinformation should be considered in more ecological contexts where misinformation is often introduced and disseminated to further examine its correction potential.

Notes

1. Collaboration was only introduced during the questionnaire since collaboration in recall tasks usually results in collaborative inhibition (Weldon & Bellinger, 1997). For instance, previous studies using the misinformation paradigm with a subsequent collaborative recall observed a collaborative inhibition effect generalized across both correct and misinformation (e.g., Saraiva et al., 2021).
2. This first recall task served as a baseline to determine whether the correct information recalled in the second recall task was already encoded after the original event or if it was encoded during the questionnaire.
3. We confirmed that both participants marked the group's answer in their respective questionnaire (i.e., free-for-all condition) or their own answer and that of the other group member (i.e., turn-taking condition). In free-for-all conditions, participants' answers matched the answers of the other group member in 100% of the cases.
4. For example, if one item (correct or false) presented in the questionnaire had already been recalled in the first recall task, the proportion would become X/15 instead of X/16.

Open Scholarship

This article has earned the Center for Open Science badges for Open Data and Preregistered. The data and materials are openly accessible at https://osf.io/ym3kr/?view_only=9e51b04eefa14e00a46936632935a709 and https://aspredicted.org/7S9_KFS.

Data availability statement

The data for the experiment is available at OSF (https://osf.io/ym3kr/?view_only = 9e51b04eefa14e00a46936632935a709), and the study was preregistered at AsPredicted (https://aspredicted.org/7S9_KFS).

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