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Suggested false memories of a non-existent film: forensically relevant individual differences in the *crashing memories* paradigm

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Suggested false memories of a non-existent film: forensically relevant individual differences in the *crashing memories* paradigm

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ABSTRACT

There is ample evidence to suggest that posing leading questions is dangerous, in that it may elicit compliant responses that are not necessarily accurate. Further, suggestive questioning is considered to possibly result in the development of false memories, implied in the suggestion. [Crombag, H. F. M., Wagenaar, W. A., & van Koppen, P. J. (1996). Crashing memories and the problem of 'source monitoring'. Applied Cognitive Psychology, 10(2), 95–104. https://doi.org/10.1002/(SICI)1099-0720(199604)10:2<95::AID-ACP366>3.0.CO;2-#] introduced a *crashing memories* paradigm in which participants are asked a single leading question about a non-existent film. The present research sought to replicate the false-memory-eliciting effect of the *crashing memory* induction. Further, we sought to explore associations with forensically relevant personality traits, particularly acquiescence, compliance, and suggestibility. In two studies, a significant minority of participants endorsed the leading question about the non-existent film (25.7%, and 38% respectively). We found no support for an association with acquiescence or compliance, but suggestibility was associated with the development of false memories.

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False memories; crashing memories; suggestion; acquiescence; compliance; suggestibility

Introduction

There is a long tradition of memory research targeting the fallibility of recollections. Indeed, memory has been found to suffer from omission error cause by decay (Jenkins & Dallenbach, 1924), but also from distortion and commission error caused by spontaneous source monitoring flaws (Carmichael et al., 1932), spontaneous reconstruction (Jacoby et al., 1989; Roediger & McDermott, 1995), and natural conversation about a remembered event (Crombag, 1999; Tversky & Marsh, 2000; see for reviews, Loftus, 2003; Schacter, 1999).

A less benign path to false memories is by third parties posing leading questions, albeit that not all suggestive questions are intended to distort memory. A hallmark study of the detrimental effect of suggestion on memory was done by Loftus and Palmer (1974). These authors showed undergraduates a short film fragment depicting a car crash. Next, they asked participants to estimate the speed of the cars using different words, such as *hit* and *smashed*. The authors found that the intensity implied in the word used to describe the car accident affected the estimated speed, as well as the likelihood that participants misremembered shattering windshields.

Crombag et al. (1996) introduced their *crashing memories* paradigm in which they managed to make participants remember film footage that they in fact had not seen at all. They asked 193 respondents whether they had seen live film footage of a plane crash on October 4, 1992. In this accident, a cargo plane crashed into a building. The crash caused dozens of deaths, and was considered a major disaster in the Netherlands. In reality, film footage of the crash does not exist. No less than 107 (i.e., 55%) respondents answered this suggestive question affirmatively. These respondents were subsequently asked whether they remembered seeing fire break out at impact, or after a delay. Sixty three of them (59%) remembered seeing the fire occur at impact, 24 (23%) thought they had seen a short delay, and 20 (18%) testified they did not remember. In a replication in a sample of 93 law undergraduates, 66% misremembered seeing the film, and again, a significant proportion of them answered detailed questions about the occurrence of fire (67%), the position of the plane (horizontally versus vertically; 77%), and about what happened to the plane after impact (e.g., disintegration, falling on the ground, or remaining stuck in the building; 49%).

By now, the findings by Crombag et al. (1996) have been replicated a number of times with various target events as stimulus. Table 1 presents an overview of studies employing the *crashing memories* paradigm. As can be seen in the bottom line of this table, the grand mean of participants yielding into the suggestion is 45%,

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Data (SPSS) can be obtained from the author. The presented research was approved by the ESSB ethical committee. All participants gave informed consent prior to participation.

Table 1. Overview of findings in crashing memories studies.

	Sample size	Participants confirming having seen the film	Participants reporting details of the film
Crombag et al. (1996)	286	168	87
Ost et al. (2002)	45	20	–
Granhag et al. (2003)	182	82	–
Jelicic et al. (2006)	83	52	19
Ost et al. (2006)	48	19	–
Sjoden et al. (2009)	160	103	30
Smeets et al. (2006)	120	47	25
Wilson and French (2006)	100	36	34
Ost et al. (2008)	100	28	–
Smeets et al. (2009)	88	58	6
Patihis and Loftus (2016)	202	74	68
Patihis et al. (2018)	365	122	108
Total	1779	809	424

and the mean percentage of participants actually reporting false memories, for example by conjuring up specific details from the non-existent film, is 24%. Hence, this research paradigm confirms that people are quite susceptible to leading questions. Meanwhile, the occurrence of suggested false memories has been associated with situational factors, such as peer pressure (i.e., knowing that other people claim to have seen the pertinent film; Granhag et al., 2003), precise wording of the leading question (e.g., "Did you see *the* film?" will produce more confirming responses than "Did you see *a* film?"; Smeets et al., 2006), and explicitly thinking about the plausibility that the pertinent film exists (such deliberation will suppress positive responding; Smeets et al., 2009).

Some of the studies have addressed the question of individual differences in susceptibility to the *crashing memories* effect. So far, findings are rather limited and mixed. Some researchers have found that women are more likely to yield into the leading question than men (Crombag et al., 1996; Jelicic et al., 2006; Sjoden et al., 2009), but others failed to find any gender effect (Granhag et al., 2003; Ost et al., 2002, 2006; Patihis & Loftus, 2016; Smeets et al., 2009). Age is generally not found to be related to endorsement of the leading question (Jelicic et al., 2006; Ost et al., 2002; Patihis & Loftus, 2016; Smeets et al., 2009). Some authors reported a positive association between falling prey to the suggestion and dissociative tendencies (Ost et al., 2008; Wilson & French, 2006), whereas others found no such association (Ost et al., 2002; Patihis et al., 2018; Patihis & Loftus, 2016). Likewise, several authors reported a positive association with fantasy proneness (Jelicic et al., 2006; Ost et al., 2008; Patihis & Loftus, 2016; Patihis et al., 2018, Study 1), but others did not (Patihis et al., 2018, Study 2; Sjoden et al., 2009). Notably, fantasy proneness appears to be primarily related with spontaneous memory errors (e.g., Geraerts et al., 2005), but less so with false memories caused by suggestive intervention (e.g., Merckelbach et al., 2000, 2022). Strikingly, fantasy proneness during encoding has even been argued to increase perceptual involvement and consequently quality of recollections (Patihis, 2016). Finally, participants who affirmed to have seen non-existent film footage have been reported incidentally to score higher on paranormal experiences (Wilson & French, 2006) and self-reported alcohol consumption (Patihis & Loftus, 2016).

Strikingly, a few personality characteristics that may, at face value, seem very relevant for the susceptibility to the leading question in the *crashing memories* paradigm, seem to have been overlooked in this literature. For example, compliance, defined as "the tendency to go along with propositions, requests or instructions, for some immediate instrumental gain" such as eagerness to please, preservation of self-esteem, or avoidance of conflict (Gudjonsson, 2003, p. 370) may well fuel susceptibility to suggestive questions. Interestingly, Smeets et al. (2006) did have participants complete Gudjonsson's (1989) Compliance Scale, but did not report data on the association between scores on that scale and reports of having seen non-existent film footage. Likewise, acquiescence, that is, "the tendency to answer questions in the affirmative irrespective of the content" (Gudjonsson, 2003, p. 376) seems to be a relevant personality characteristic in this research. Also, suggestibility ("the extent to which, within a closed social interaction, people come to accept messages communicated during formal questioning, as the result of which their subsequent behavioural response is affected"; Gudjonsson, 2003, p. 345) seems to be a variable of interest. Admittedly, these three traits have traditionally been construed as relevant to the context of suspect interrogations rather than witness interviewing. Indeed, recent research suggests that compliance and suggestibility are predictive of giving false confessions (Otgaar et al., 2021). Nonetheless, the traits are arguably relevant to memory research as well.

The purpose of the present research was to add to the *crashing memory* literature by seeking replication of the false memory-eliciting effect, and by exploring possible associations between the suggested false memory and various forensically relevant personality characteristics, that is, compliance, acquiescence, and suggestibility.

Study 1. Compliance and acquiescence

In the present study, we targeted participants' compliance and acquiescence tendencies as possible correlates of the susceptibility to leading questions in the *crashing memories* paradigm.

Method

Participants

Two hundred-and-eighteen general community volunteers were included. Participants were recruited via convenience sampling from the social network of the researchers. Using G*power, we estimated a required sample size (medium effect size of 0.5, *alpha* = .050, power = .80) of 102 to detect differences in the individual difference measures. Hence, our sample should be large enough to reliably replicate previous findings as displayed in Table 1. The mean age in the sample was 31.5 years (*SD* = 12.9). There were 166 women (76%) in the sample. Participants completed the study online via Qualtrics, in absence of any compensation.

Measures and procedure

After giving informed consent, participants filled out some personal information, such as age and gender.

Target event. In 2019, a terrorist attack took place in the Netherlands that received much attention in the national media. One individual killed four random people in a tram. There is no film footage of this shooting. Hence, this traumatic events lends itself for a *crashing memory* study. Data collection took place approximately two years after the incident. Participants received the following information.

> On 18 March 2019 Gokman T committed a terrorist attack. He shot four random people in a tram in Utrecht. Hence, he has been referred to as "the tram shooter". Amateur video footage was made by bystanders. These film fragments helped the police identify and arrest the perpetrator nearby the crime scene. Gokman T was sentenced to lifelong imprisonment. The attack caused severe societal disruption. Did you see any of the film footage of the actual tram shooting by Gokman T (*no*/*yes*)? If so, describe as detailed as possible what you remember from the film(s).

The latter question was scored (1) if the participant came up with specific details (e.g., people hiding behind seats, shots being fired) that they could not have seen (i.e., of which no actual footage exists). By contrast, details derived from what was shown in the media, that is details pertaining to the events surrounding the terrorist attack (e.g., police and medical teams arriving at the scene) were scored as 0.

Table 2. Means of the variables of participants who did and did not report (confabulated) details.

	Details (n = 34)	No details (n = 184)	p-value	Effect size[a]	BF^{10}
Age	26.8 (9.1)	32.4 (13.4)	.003	0.44	2.34
Gender (% women)	88%	74%	.079	3.5	0.80
GCS (0–20; α = .66)	10.8 (4.6)	9.2 (4.6)	.060	0.37	1.01
AS (0–12; α = .58)	3.2 (1.8)	2.8 (2.0)	.300	0.19	0.32

Note: GCS = Gudjonsson Compliance Scale; AS = Acquiescence Scale; [a]Cohen's *d* for age, GCS and AS, Likelihood ratio for gender.

Trait scales. Participants completed the following personality measures, together with a few measures irrelevant for the present research.

Gudjonsson's Compliance Scale (GCS; 1989) consists of 20 *yes/no* items (e.g., "I give in easily to people when I am pressured"). Total scores range between zero and twenty, with higher scores representing bigger tendency to comply.

The Acquiescence Scale (AS; Winkler et al., 1982) consists of I2 pairs of logically opposite items measuring the respondent's attitudes toward, for example drugs, doctors, and health care (e.g., "Prescription drugs frequently do more harm than good" and "Prescription drugs are almost always helpful"). Items were answered on a 5-pointscale (1 = *strongly disagree*; 5 = *strongly agree*). One point was scored for each time the respondent scored similarly on two opposite items (e.g., both times 1 or 2, or both times 4 or 5). Hence. Total scores range from zero through twelve, with higher scores representing bigger acquiescence tendency.

Results

Of the 218 participants, 60 (i.e., 27.5%) reported to have seen film footage of the terrorist attack. Of these 60 participants, 34 (i.e., 56.6%) reported details of what had happened in the tram. That is, of all participants, 15.6% reported memories of the non-existent film. As did Jelicic et al. (2006), we compared the group of participants who reported details of the non-existent film (n = 34) to those who did not (n = 184) on the various personality variables.

We calculated Bayes factors (*BF*) using JASP (free Bayesian software available at www.jasp-stats.org) to obtain alternative insight in the support of the data for the primary (i.e., groups differ) versus the alternative (i.e., the null-hypothesis, no group differences) hypothesis, with the prior odds left undefined and hence set at 1.0 (see Jarosz & Wiley, 2014, for interpretation of *BF*s).

The means of the two groups are presented in Table 2. As can be seen in this table, age was significantly different between participants with and without false memories. Participants who reported memories of the non-existent film were younger. They also tended to be more often female and to be more compliant. Looking at *BF*, the only variable with some discriminatory power was age.

Discussion

The current study set out to replicate and extend previous findings employing the *crashing memories* paradigm, in which participants are asked a leading question about having seen a non-existent film. As to the replication attempt, a significant minority of participants was affected by the leading question. That is, 27.5% of participants was led to believe that they had seen a non-existent film. Approximately half of these (i.e., 15.6% of the total

sample) actually reported (confabulated) details about the film they supposedly had seen. Hence, the current findings fit nicely in the literature on crashing memories.

As to our attempt to extend the literature, we found some, limited evidence for individual differences as predictors of susceptibility to suggestion. That is, age was associated with reporting details about the non-existent film (the younger, the more suggestible). Findings regarding gender and compliance were inconclusive and somewhat disappointing. That is, there was a nonsignificant trend ($.050 < p < .100$) for both characteristics, but the *BF*s were close to one. Acquiescence was not associated with the *crashing memory* effect, whether judging from hypotheses significant testing (HST) or *BF*.

Study 2. Compliance and suggestibility

In this second study, we sought to explore the relation between suggestibility and susceptibility to the *crashing memory* effect. Participants also completed the GCS, because the findings in Study 1 regarding the relevance of compliance were inconclusive.

Method

Participants

Using G*power, we estimated a required sample size (medium effect size of 0.5, *alpha* = .050, power = .80) of 102. A hundred-and-one undergraduates participated in this study in return for course credits. The mean age in the sample was 20.8 years ($SD = 3.0$). There were 85 women in the sample. Participants completed the study online via Qualtrics.

Measures and procedure

Target event. The target event was identical to the one in Study 1.

Trait scales. Participants completed the GCS (Gudjonsson, 1989), and Gudjonsson's Suggestibility Scale (GSS; Gudjonsson, 1984). The GSS is a memory test, rather than a self-report, because suggestibility is considered to be unsusceptible to introspection and self-report (Gudjonsson, 2003). The administration of the GSS starts with the participant being exposed to a short story about a woman who gets robbed while on vacation. After providing a free recall, the respondent is presented sequentially with 20 questions, 15 of which are leading in that they imply information that was actually not included in the story. The yield score is the number of times that the respondent answers leading questions in a manner that exemplifies being influenced by the suggestion (range 0–15). Finally, the respondent is given some negative feedback implying that several mistakes were made, and is then asked to complete the 20 questions once more. Every answer on the 15 leading questions in this second round that diverges from the one given in the first round counts as a shift (shift score ranges from 0 through 15). The yield and shift scores are then summed into a total suggestibility score (range 0–30) with higher scores indicating greater susceptibility to suggestive questions.

Table 3. Means of the variables of participants who did and did not report (confabulated) details.

	Details ($n = 26$)	No details ($n = 75$)	*p*-value	Effect size[a]	BF^{10}
Age	20.4 (2.8)	20.9 (3.0)	.416	0.19	0.24
Gender (% women)	96%	82%	.092	3.5	0.65
GCS (0–20; $\alpha = .77$)	10.5 (4.1)	10.5 (4.1)	.984	0.01	0.17
GSS (0–30; $\alpha = .45$)	7.0 (2.8)	5.2 (3.0)	.009	0.62	4.35
Certainty (1–7)	5.1 (1.1)				
Plausibility (1–7)	5.0 (1.3)				
MCQ (1–7; $\alpha = .84$)	3.3 (0.6)				

Note: GCS = Gudjonsson Compliance Scale; GCS = Gudjonsson Suggestibility Scale; MCQ = Memory Characteristics Questionnaire; [a]Cohen's *d* for all variables except gender (effect size expressed in Likelihood ratio).

Memory questions. Participants who claimed to have seen the pertinent film were asked several additional questions, all with a 7-point answer format (1 through 7). Participants indicated how certain they were that they had actually seen the film. Second, they indicated how plausible it is that they had seen the film. Third, they completed 34 items of the Memory Characteristics Questionnaire (MCQ; Johnson et al., 1988). The MCQ measures various metamemory characteristics such as clarity, sensory information, context, temporal information, and thoughts and feelings, of the recollection. These measures were taken to explore whether compliance and suggestibility are associated with the richness of the false memory.

Results

Of the 101 participants, 38 reported to have seen film footage of the terrorist attack. Of these 38 participants, 26 (i.e., 68.4%) reported details of what had happened in the tram. The means of the participants who did ($n = 26$) and did not ($n = 75$) report details of the non-existent film are presented in Table 3. As can be seen in this table, age did not differentiate between participants with and those without memories of the film. Neither did compliance. Gender tended to be non-significantly different. Suggestibility was higher in participants with false memories, both when looking at results of HST and *BF*.

Finally, we explored the effect of age, gender, compliance, and suggestibility, if any, on the richness of the false memory evoked by the crucial leading question as expressed by certainty, plausibility, and MCQ-score. To this end, correlations were computed in the subsample of 26 participants (*t*-tests for gender). The only significant finding was a negative correlation between age and MCQ score ($r = -.57$, $p = .008$). Age ($r = .39$, $p = .058$). and scores on the GSS ($r = .30$, $p = .141$) slightly tended to

correlate with self-reported plausibility. All other computations yielded nonsignificant outcomes (*ps* > .236).

Discussion

The present findings resemble those of Study 1 in that females non-significantly tended to be overrepresented in the group of participants who reported details of the non-existent film. Further, while in contradiction with Study 1, the two groups of participants did not differ in age, age did correlate negatively with metamemory characteristics. It should be noted that the current student sample was more homogenous in age, compared to the general community sample in Study 1. The current data add to the inconclusive findings in Study 1 in that compliance was not at all related to the development of false memories. In line with expectations based on theory, suggestibility was associated with false memory. As to correlations with the measures of memory richness, it must be admitted that the current subsample size only allowed for the detection of large effect sizes.

General discussion

The purpose of the current research was to seek replication of the *crashing memory* effect, and to explore possible associations with forensically relevant traits, particularly acquiescence, compliance, and suggestibility. As to the replication, a significant minority (in Study 1, 27.5%, and in Study 2, 38%) of participants endorsed the leading question about having seen a non-existent film fragment. Of these, more than half displayed signs of false memories by providing details from the non-existent film. Hence, the findings fit nicely with the existing literature.

The findings regarding relevant individual differences in the susceptibility to the *crashing memories* effect are not easy to summarise. First, we found some evidence for a protective effect of age. In Study 1, but not in Study 2, participants with false memories tended to be younger than those who were unaffected by the suggestion. In addition, in Study 2, age correlated negatively with the richness of the false memory as measured with the MCQ. In both studies, women tended to be over-represented in the group with false memories, but this effect was not significant, and yielded *BF*s around or even smaller than 1. We found little or no evidence for an association between false memories and acquiescence or compliance. We found significant (HST) and positive/substantial (*BF*) support for an association between suggestibility and the development of false memory. The latter finding makes theoretical sense, because suggestibility by definition makes vulnerable to developing suggested false memories (e.g., Gudjonsson, 2003). The findings also support the idea that compliance and suggestibility are distinct (cf. Mastroberardino & Marucci, 2013). Theoretically, people who score high on compliance would endorse a leading question, but not develop a false recollection subsequently. By contrast, people high on suggestibility are hypothesised to actually develop false memories when exposed to suggestion. Hence, it is to be expected that scores on the GSS correlate with false memory richness (e.g., MCQ). While such a correlation was observed, it failed to reach significance, but that may partly be due to the small subsample of participants reporting details ($n = 26$) and the consequent limited power. Notably, suggestibility also seems to do better than compliance in predicting false confessions (Otgaar et al., 2021). Meanwhile, the question remains whether suggestion in this paradigm results in memories that can be considered to be real recollections or rather beliefs (cf. "I must have seen that film, because I have a clear mental image of it"). Obviously, some people will imagine details from a public traumatic event (such as the topic of this research) spontaneously, regardless of being exposed to suggestion. Such individuals may quite easily be convinced that they actually saw a film of the incident, when placed in an experimental context as the current.

A broader look at different paradigms to elicit false memories suggests that these paradigms may not be strongly associated with each other, nor with personality traits. Patihis et al. (2018) had participants undergo various false memory paradigms. For example, they were given twenty Deese-Roediger-McDermott (DRM) lists, in which an association is present that will make participants falsely remember a not listed but associated word. For example, the list "mad, fear, hate, rage, temper, fury, ire, wrath, happy, fight, hatred, mean, calm, emotion, enrage", may make the participants falsely remember the word "anger" (i.e., the critical lure). The assignment is to retain the words and reproduce them sometime later. Notably, the DRM test does not (only) test recall, but particularly spontaneous reconstruction of memory. Participants were also asked about their memory for a film of the United 93 airplane crash (which does not exist). Also, they were asked to imagine what the footage looks like, if they had no recollection of it. As in many studies, participants turned out to be susceptible to one or the other paths to false memories. However, there were no intra-individual associations between the different paths to false memories. In other words, the paradigms did not correlate. Personality traits also hardly correlated with the development of false memories. For example, absorption, mindfulness, impulsivity, social desirability, embitterment, and aggression did not predict the development of any of the false memories. The only somewhat predictive personality traits were fantasy proneness, dissociation, and anxiety.

A limitation of the present studies is that they relied on online data collection. Hence, the researchers could not supervise participants, and could not for example exclude that participants would search the internet for pertinent film footage, before completing the procedure. If participants actually took the trouble of doing so, and

would find nothing, they might then have answered the crucial question negatively. Hence, it can be argued that the present findings represent a low estimate of population values. An inherent strength of the *crashing memories* paradigm is that it concerns the development of false memories about a real-life traumatic incident. Hence, the paradigm has strong ecological validity. Indeed, the findings confirm that traumatic memories are not immune to problems of omission and commission (see also Engelhard et al., 2008; Wagenaar & Groeneweg, 1990).

As to implications of the current findings, besides the importance of periodically replicating psychological "facts", it would for practical purposes be very interesting to have ways to predict vulnerability to the development of false memories. Such prediction would for example be important to roughly estimate the validity of eyewitness testimony. It seems that mistaken eyewitness testimony is a major cause of miscarriages of justice (Saks & Koehler, 2005). If a witness scores high on traits associated with vulnerability to developing false memories is interviewed in a leading manner, this information may help evaluate this witness' testimony critically. Meanwhile, the findings stress the danger of leading questions.

In sum, the findings confirm that a significant minority of people are seduced by leading questions, and that this results in actual false memories for some of them. Particularly, the GSS deserves attention in future studies as a measure that may help discriminate people at increased risk of falling prey to suggestion.

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