

When People Remember Dreams They Never Experienced: A Study of the Malleability of Dream Recall Over Time

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The source-monitoring paradigm suggests that dreams could be an important source of naturally occurring false memories. However, the malleability of memories for dreams remains to be investigated. The purpose of this study was to evaluate the impact of suggestions on subsequent dream recall. Immediate dream recall collected in a sleep laboratory was compared with long-term recall 1 to 2 weeks later. Standard recall was also compared with hypnotic recall. Suggested elements were reported by 15% of the 26 participants. The hypnotic condition showed no differential effect. It was also found that between 3% and 7% of the dreams reported in long-term recall were probably naturally occurring false memories of dreams. These findings suggest that situations of misinformation can easily elicit false memories of specific dreams.

Keywords: autobiographical memory, dreams, false memories, hypnosis, source monitoring

For a long time the research fields of dream recall and autobiographical memory were quite independent. Traditionally, research on dream recall focused on finding the sources and correlates of dream content (for a review of each, see Nielsen & Stenstrom, 2005; Domhoff & Schneider, 2008) and explaining dream recall and forgetting (e.g., Beaulieu-Prévost & Zadra, 2007; Schredl, 2007). Meanwhile, research on autobiographical memory focused on its reliability and reconstructive aspect, including processes involved in the emergence of false memories (e.g., Loftus & Pickrell, 1996).

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The two fields began to merge and interact when a growing number of studies suggested that dreams could be a major source of naturally occurring (as opposed to experimentally induced) false memories (e.g., Johnson, Kahan, & Raye, 1984). From the idea that dreams can play an important role in memory distortion emerged the need to understand whether dream memories and autobiographical memories of events were processed in the same way by the brain (i.e., encoded, reconstructed and recalled) or whether they were processed by qualitatively different systems. The goal of the present study was to add to this line of thinking by assessing the malleability of dream recall with an experimental paradigm adapted from the field of memory distortion.

DREAM EXPERIENCES AS SOURCES OF FALSE MEMORIES

It has long been hypothesized that experiences of *déjà vu* (i.e., feelings of familiarity in the absence of recollection) were either triggered by dream memory fragments when similar situations were reencountered (Baldwin, 1889, in Brown, 2003) or actual dream states intruding into waking consciousness (Zuger, 1966). Similarly, sleep paralysis (i.e., a phenomenon in which people wake up feeling paralyzed and experience dreamlike hallucinations) is hypothesized to be one source for some memories of unusual experiences such as alien abductions, sexual abuse, and the succubus legend (Powell & Nielsen, 1998; McNally & Clancy, 2005). It was also reported that patients with narcolepsy could misinterpret their dreamlike hallucinations as real events (Hays, 1992; Szücs, Janszky, Holló, Miglécz, & Halász, 2003). However, none of these hypotheses was empirically tested, and they were never clearly integrated into theories of autobiographical memory.

The first theory to create a bridge between the two fields was the source-monitoring paradigm (Johnson, Kahan, & Raye, 1984), which provided the necessary framework for memory researchers to conceptualize memory for dreams as a type of autobiographical memory.

From its inception, the source-monitoring paradigm (Johnson, Hashtroudi, & Lindsay, 1993) suggested that dreams could be one of the major sources of naturally occurring false memories. According to this paradigm, one major element that helps people differentiate between memories of self-generated (e.g., imagined) events and memories of perceived events is the fact that memories of self-generated events generally carry with them memories (or traces) of the conscious cognitive operations that were required to generate them. From that point of view, false memories occur when the memory of a self-generated event is misattributed to an external source.

However, as demonstrated by Johnson, Kahan, and Raye (1984), dreams constitute a special case of self-generated events: although they are spontaneously generated (i.e., without conscious effort, reflection or planning), they do not carry with them traces of conscious cognitive operations, thereby rendering them theoretically harder to distinguish from real life events.

In one study of dreams and source monitoring (Johnson, Foley, Suengas, & Raye, 1988), participants assessed the phenomenological characteristics of memories of dreams as well as of external events. When compared with memories of events, memories of dreams were generally evaluated as including less perceptual

and contextual information and fewer relations to other memories. According to the source-monitoring paradigm, source attribution is based on these characteristics of memories. Consequently, memories of dreams including an especially high amount of perceptual and contextual information and relations to many memories of perceived events would be at greater risk of being misattributed (i.e., falsely recognized) as memories of perceived events.

It was also proposed that the characteristics of dream memories are similar to those of childhood memories: both lack sufficient knowledge, cognitive processes, and frontal development for a referenced memory to be encoded (Horton & Conway, 2009). This suggests that it would be easier to misattribute a dream memory to a childhood event than to a recent event.

But to what extent do people experience dreams whose recall is so realistic that they can be confused with real perceived events? Two surveys of nonclinical populations investigated this question (Rassin, Merckelbach, & Spaan, 2001). According to their combined and weighted results ($n = 340$), 76% of the respondents reported that they had experienced at least one dream that was so realistic that they initially believed it had occurred in real life. Furthermore, 14% of the respondents also reported that they had memories for which the source (i.e., dream vs. real events) was unclear to them. Furthermore, respondents who reported experiences of confusion between dreams and reality scored higher on measures of fantasy proneness and dissociation than respondents who did not report such experiences.

In a two-part study, Kemp, Burt, and Sheen (2003) investigated memories of uncertain origin with a student population. They found that (a) half of 68 respondents had memories whose origin (dream or real) they were unsure of and that many of these memories were from a long time ago, and (b) 22% of 73 respondents reported memories of uncertain origin from the previous 3 months. In a third study by the same group (Kemp & Burt, 2006), 73% of 358 undergraduates reported having a memory whose origin, real or dreamt, was uncertain. Although most uncertain memories were mundane in nature (e.g., a conversation with a friend), some were significant (e.g., sexual abuse, minor theft, being hit). Most respondents who resolved their uncertainty concluded that the event had been a dream.

The idea that dreams can be mistaken for or confused with perceived events was also explored by Mazzoni and Loftus (1996), who showed that individuals can be led to falsely believe that words originating from their dream reports had been seen on a list presented to them earlier during the experiment. Moreover, a subsequent series of studies from the same group (Mazzoni & Loftus, 1998; Mazzoni, Lombardo, Malvagia, & Loftus, 1999; Mazzoni, Loftus, Seitz, & Lynn, 1999) showed that a 30 minute session of dream interpretation could be used to make people believe they had experienced a critical childhood event (e.g., being harassed by a bully or being lost in a public space) before the age of three and even to produce memory reports consistent with the suggestion.

More recently, it was suggested that people with frequent dissociative experiences are more prone to create false memories as a result of intrusions into wakefulness of dreamlike experiences that interfere with source-monitoring abilities (van der Kloet, Merckelbach, Giesbrecht, & Lynn, 2012).

Taken as a whole, these studies converge to suggest that dream memories play an important role in the production of false autobiographical memories and that memories of uncertain origin (real or dreamt) may be more common than generally recognized.

SIMILARITIES BETWEEN DREAM MEMORIES AND AUTOBIOGRAPHICAL MEMORIES OF EVENTS

The inclusion of dreams in theoretical models of memory distortion gave rise to a recent body of literature that began to compare various aspects of dream memories and autobiographical memories of events. It was found that three main features of autobiographical memories were also shared by memories for dreams: childhood amnesia (the lack of memories from the first few years), the reminiscence bump (an increased recollection for events that occurred during adolescence and early adulthood), and the recency effect (a higher recall for recent events; Grenier et al., 2005).

It was also shown that memory characteristics facilitating waking event recall also facilitate dream recall (i.e., bizarreness, emotionality, personal salience; for a summary, see Horton & Conway, 2009), and that the retrieval trends of the two types of memories were comparable in the medium term (Horton, 2011a). Finally, a recent review suggests that the neurophysiological mechanisms of encoding and recall of episodic memories are largely comparable across wakefulness and sleep (De Gennaro, Marzano, Cipolli, & Ferrara, 2012).

Globally, these studies support the idea that memories of dreams are encoded and recalled using the same neurocognitive mechanisms as any other autobiographical memory, and not via a parallel system with its own rules. If dream memories and memories of events can be considered intrinsically similar, it follows that problems of source misattributions could also happen to dream memories and result in false memories of dreams. In fact, one recent theoretical article (Rosen, 2013) hypothesized that false memories are far more common for dream memories than for memories of events. However, empirical studies have yet to examine the malleability of dream memories and, to our knowledge, false memories of dreams have not been investigated.

This body of literature raises key questions that remain unanswered: How malleable are memories of dreams compared with memories of external events? To what extent can we trust childhood dreams that are recounted by adults to friends or therapists? Can we generalize what is known about the malleability of memories of events to memories of dreams? Because dreams are a likely source of false memories, their malleability has a direct impact on the malleability of autobiographic memories of events.

The main goal of the present study was to provide initial answers to some of these questions by investigating, for the first time, the impact of suggestive techniques on dream recall. A second goal was to investigate three aspects of long-term dream recall: the proportion of dreams recalled, the necessity of a morning dream recall to allow for long-term recall, and the probability of naturally occurring false memories of dreams in long-term recall.

To achieve these goals immediate dream recall, as recorded in a sleep laboratory, was compared with long-term recall reported 2 to 3 weeks afterward. In addition, two false dream-like sequences were suggested to participants while in the sleep laboratory via a misinformation procedure to assess whether or not these false dreams would be incorporated into subjects' long-term recall as genuine dream experiences. Finally, one group of participants assigned to a standard recall protocol was compared with a group assigned to a hypnotic protocol. Hypnosis was also included in the project because of its recognized ability to facilitate the creation of false memories of events (Lynn, Matthews, & Barnes, 2009).

Regarding the impact of misinformation, it was predicted that, during the postsleep laboratory interviews, a significant minority of participants would falsely remember at least one of the two suggested dream experiences. It was also hypothesized that the proportion of participants falsely remembering the suggested dream experiences would be greater in the hypnotic condition as compared to the standard recall condition. No prediction was made concerning the investigation of long-term dream recall.

METHOD

Participants

Thirty-seven participants were originally recruited via ads placed on a university campus. Participants were told that the purpose of the study was to understand cognitive processes related to dream recall. Twenty-six participants (18 women and 8 men) completed every phase of the study. A \$25 compensation was offered for the two nights in the sleep laboratory and \$25 following the last follow-up interview.

Procedures

Laboratory-Based Dream Recall

The study was conducted in two successive phases. During phase 1, participants spent two consecutive nights in a sleep laboratory. EEG recordings and electrode placement were performed according the international 10–20 system and standard polysomnographic measures including electro-oculograms, submental electromyography, and electrocardiogram were recorded on both nights. Depending on subjects' habitual sleep-wake cycle, lights off was between 22:00 and 24:00 and wake time occurred between 6:00 and 8:00.

Participants were awakened from REM sleep for dream recall two or three times during each night (10 minutes into the 2nd REM period or after 15 minutes for subsequent REM periods). Following each awakening, the technician first asked the participants if anything had been going through their minds before being awakened and, if so, to provide a detailed description of the sleep mentation recalled before letting the participant fall back asleep. All dream reports were audio taped and later transcribed. As soon as participants awakened in the morning, they were given a dream recall form on which all dream material and

images recalled from the night had to be briefly summarized. The purpose of this morning recall was to maximize the long-term recall of the dream material and to obtain an additional measure of the material recalled.

Misinformation

Two misleading pieces of information were given to the participants during their stay in the sleep laboratory to examine whether some of them would, over time, involuntarily transform these elements into a personal dream memory. While the electrodes were being removed from participants after night 1, the technician informally told them that they had spoken during their sleep and that he had heard them say: "Be careful, the dog is asleep." The purpose of this misinformation was to provide a false external evidence of dreaming about a specific topic. While the electrodes were being removed after night 2, the technician told participants that he had briefly fallen asleep during the night and recounted a brief dream he had supposedly experienced. The story was recounted informally to reduce the participants' chances of remembering the context surrounding the exposure to the story and thus increase the probabilities of source amnesia. It also was short, simple, and included the participant as one of the dream characters to facilitate the incorporation of the story into the participants' dream narratives. In addition, the story contained a few specific elements (e.g., a party in a shopping mall and the presence of a green balloon) to insure a certain salience and to allow the detection of incorporations into participants' future dream narratives.

Follow-Up Interviews

Approximately one week after their stay in the sleep laboratory, participants were contacted by the experimenter to inquire whether they were interested in taking part in a second study that comprised two interviews, to be held one week apart. Participants were told that the purpose of the interviews was to evaluate the quality of their recall of the two nights spent in the sleep laboratory and of the dreams they had experienced during that time. They were informed that half of the participants would be asked to recall the events in a hypnotic context and they were informed about the condition to which they had been randomly assigned. Before this, no mention had been made of the second phase of the study to avoid that participants try to actively memorize their dreams or other laboratory-based experiences for subsequent recall.

Each interview consisted of two successive recall sessions during which participants were invited to describe in the most complete way possible their visit to the sleep laboratory and, especially, the dreams they had during their two nights there. Participants were informed that the interviewer did not know any details relating to the laboratory setting nor the content of the dreams that they had reported. This protocol allowed the elicitation of a free recall that was as detailed as possible without suggesting any details. When the participants stated that their recall was completed, they were asked whether they could remember anything else. The first recall session of each interview was terminated when the participants

answered that they did not remember anything else. The second recall session began immediately after the end of the first recall.

The procedure for the second recall session differed according to the group conditions. Participants assigned to the standard protocol were given the same instructions as for the first recall but were also asked to try not to forget any detail, however meaningless it may appear. The same protocol was used with participants assigned to the hypnotic condition, except that the recall was preceded by a hypnotic induction adapted from the *Stanford Hypnotic Susceptibility Scale, Form C* (Weitzenhoffer & Hilgard, 1962), in which the participant is brought to reexperience the events before describing them. The hypnotic induction was terminated after the recall. Each recall was audio taped and subsequently transcribed. The last interview ended with a debriefing.

Each interview's transcribed verbatim was then assessed for the presence of elements from the sleep talking suggestion or the dream recounted by the technician. If a dream was mentioned only in the second phase of the study and included at least one of the suggested elements (e.g., a dog, a green balloon), it was considered as a false memory. However, a claim of false memory was only made if (a) the elements were clearly and explicitly attributed to a dream, and (b) no doubt was raised by the participant concerning the memory's origin or validity.

Analyses

The impact of misinformation was assessed by calculating the proportion of participants who reported in phase 2 at least one dream not originally reported in phase 1 and containing at least one of the suggested elements (i.e., a dog, a party, a shopping mall, or a balloon). To ensure a conservative assessment of the number of false dream reports resulting from the misinformation, dream reports were excluded if the participant expressed doubts about the experience (e.g., *I'm not sure but I think that I dreamt about . . .*) or if it was not reported during the last follow-up interview. The false dream reports resulting from the misinformation were identified by two independent judges and the interrater reliability was calculated to assess the reliability of the method. The differential effect of hypnosis versus a standard interview was assessed by comparing the proportion of individuals reporting a suggested dream between the two groups.

For the investigation of long-term dream recall, the dream reports including suggested elements were excluded from the analyses. The proportion of dreams recalled in the second phase was calculated by verifying for each dream reported in phase 1 (i.e., REM-sleep awakening and/or morning recall) which ones were reported at least once in phase 2. To evaluate the extent to which the presence of a morning recall (MR) of a dream is necessary for the presence of its long-term recall (LR), the sensitivity of MR as a "diagnostic indicator" of LR, also known as $p(\text{MR}/\text{LR})$, was calculated for dreams reported during a nighttime recall (i.e., REM-sleep awakening).

The probability of naturally occurring false memories of dreams in the long-term recall was also inferred in the eventuality that some dreams reported in phase 2 were not previously reported in phase 1. Dreams reported for the first time in phase 2 could theoretically be either (a) reports of dreams really experienced

during the nights at the sleep laboratory but not reported during REM-sleep recall or morning recall, or (b) reports based on naturally occurring false memories of dreams. But how can we confidently estimate the probability that these additional reports represent valid memories from dreams experienced but not reported in phase 1, and not naturally occurring false memories of dreams? There is basically no direct way to know whether or not these reports are based on real or false memories. However, we designed an indirect method to estimate the probable number of false memories among them.

The method is based on the assumption that the efficacy of a morning recall to predict the presence of a long-term recall (as measured by the sensitivity of the morning recall) should not depend on whether or not the dream experience was previously reported during a REM-sleep awakening. After calculating $p(\text{MR/LR})$ for dreams previously reported during a night recall, the resulting sensitivity is applied to dreams not previously reported during a night recall and used to deduce the expected number of long-term dreams reports not previously reported in phase 1 from the observed number of long-term reports associated to a morning recall but not previously reported during a night recall. This expected number of dreams reported in phase 2, but not in phase 1, is then compared with the observed number, and the difference represents extra dream reports beyond what would reasonably be expected from the estimated sensitivity of morning recall. Therefore, these extra reports can be inferred to represent naturally occurring false memories of dreams.

For all the calculations, the confidence level was set at 95%. Confidence intervals of proportions were calculated according to the Wilson method (for details, see Newcombe, 1998b), and confidence intervals of differences between proportions were calculated with the Newcombe-Wilson method (Newcombe, 1998a).

RESULTS

Participants recalled an average of 3.5 ($SD = 1.4$) dream reports over the two consecutive nights of experimental awakenings from REM sleep. If the spontaneous recall of dreams following natural morning awakenings is included, an average of 5.1 dreams ($SD = 2.3$) was reported by participants during their two nights at the sleep laboratory.

During the post sleep-laboratory interviews, five of the 26 participants (19%) reported that they had dreamt about a dog (incorporation of the suggestion related to sleep talking) and 2 (7%) reported that they had dreamt about a party or green balloons (incorporation of technician's dream). These elements of the dream memories did not correspond to any of the actual dreams reported in the sleep laboratory. Of the five participants who reported a dream about a dog, three had doubts about the validity of their memory during their first follow-up interview. None of these three participants reported this dream during the second interview, suggesting that they either did not unequivocally attribute the technician's suggestion to a personal dream experience or that this false memory trace disappeared over time.

If only memories reported as being valid until the end of the study (e.g., until the end of the second interview) are considered, a total of four participants (15%; 95%CI = 6.1% to 33.5%) reported false dreams that included elements suggested by the technician. The interrater reliability for the identification of these four false reports was 100%. The four false memories resulting from the misinformation were equally distributed across the two conditions, indicating that the hypnotic condition did not facilitate the creation of false memories of dreams beyond what was observed in the standard recall condition. As shown in the following two examples, the actual content of these false dream narratives was short and generally included only the suggested elements (in bold) and some basic contextual elements:

I dreamt that there was Cruella from the 101 Dalmatians who was going to kill **puppies** in her car.

I remember a flash . . . a flash of **balloons** full of colors and a big **balloon**.

Assessing the Proportion of Recalled Dreams in the Second Phase

No statistically significant difference between the standard and the hypnotic procedures was found for the rate of recall in phase 2. Observations from the two groups were thus merged for the following analyses.

Of the 133 dreams reported in phase 1, 86 were also reported at least once during phase 2. The proportion of dreams recalled after one to two weeks was thus estimated at 65% (95%CI = 56% to 73%).

Of the 61 dream reports in phase 2 that were previously reported during a nighttime recall, 54 were also reported during the morning recall. Therefore, the sensitivity of morning recall for dreams reported during a night recall was 89% (54/61; 95%CI = 78.2% to 94.3%). This indicates that when remembering dreams one to two weeks after experiencing them, between 78% and 94% of the dreams remembered were also recalled the morning following the dream experience in the laboratory.

Inferring the Probability of Naturally Occurring False Dream Memories in Phase 2

Eleven dreams reported in phase 2 did not correspond to any dream reported in phase 1. Because 25 dreams reported in phase 2 were reported during morning recall but not during a nighttime recall, the sensitivity parameter could be used to infer that the expected number of dreams reported in phase 2 but not in phase 1 was 3.2 (95% CI = 1.5–7.0), and not 11 as was observed. Consequently, approximately 7.8 (95% CI = 4.0–9.5) of the 11 dreams reported in phase 2 but not in phase 1 remain unaccounted for and probably represent naturally occurring false memories of dreams. Because a total of 144 dreams were recalled in phase 2 (excluding those with suggested elements), we can infer that between 3% (i.e., 4/144) and 7% (i.e., 9.5/144) of the dreams reported in phase 2 were likely naturally occurring false memories of dreams.

DISCUSSION

The main goal of this study was to determine whether verifiably false memories of dream experiences could be experimentally induced. In accordance with our first prediction, some individuals reported recalling dreams from their stay at the sleep laboratory that they had not in fact experienced. Specifically, false memories of dreams were created in 15% of the participants and population inferences suggest that between 1/16th and 1/3rd of the population could be similarly affected given comparable conditions. Elements suggested to participants by the technician less than an hour after they had awakened were hence falsely attributed to personal dream experiences by these individuals. The hypnotic protocol, however, did not facilitate the creation of false memories for dreams beyond what was observed with the standard recall protocol. This result was not expected, but a recent study offers a potential explanation by suggesting that hypnosis does not lead to increased rates of confabulation when the hypnotic induction does not include social pressure for increased recall (Wagstaff, Wheatcroft, & Jones, 2011).

The results from the present study also support the idea that the presence of a morning dream recall is useful but not necessary to insure long-term recall of the dream experience. Thus, the amount of encoding of dream memories occurring at nighttime can sometimes be sufficient to ensure later recall of the dream even when there was no recall after the morning awakening.

However, the results also suggest that between 3% and 7% of long-term memories of dreams could be naturally occurring false memories of dreams. Although there is no estimation available concerning the proportion of false memories among autobiographical memories of events, it is hard to believe that proportions could be as high for memories of events. Thus, these results are compatible with Rosen's (2013) assertion that false memories could be far more common for dream memories than for memories of real-life events.

Limits

Although false dream reports were excluded from our analyses when participants expressed doubt as to their origins, their confidence in the false memory was not explicitly assessed after the interview. Confidence ratings are sometimes collected in memory creation studies and could have improved the present method. A second limit is that the conclusion that some of the dream reports reported during phase 2 represent naturally occurring false memories of dreams was based on the assumption that the sensitivity of morning dream recall should not depend on whether or not the dream was previously reported during a nighttime recall. Although this assumption appears reasonable, it could not be tested and conclusions could differ if this assumption was found to be incorrect.

Contextualization of the Results

The results from two studies comparing dream memories and memories of a short film presented after a nocturnal awakening suggest that the content of

morning dream reports is generally reliable but also includes a small proportion of fabricated elements (Montangero, Ivanyi, & de Saint-Hilaire, 2003; Moorcroft, McFarland, et al., 2001; Moorcroft, Wronkiewicz, et al., 2001). In addition, Horton's (2011b) study on the effect of rehearsal on dream memories provided evidence that dream memories are potentially more susceptible to disruption than memories of real-life events and that the validity of long-term dream reports is questionable. The present study supports the ideas derived from these previous studies: Dream recall is malleable and the long-term validity of dream memories is questionable.

When compared with data obtained from classical studies of memory creation, the proportion of successful memory creations found in the present study could be considered low: whereas the rate of success in classical nonhypnotic protocols ranges between 20% and 29% (e.g., Hyman, Husband, & Billings, 1995; Loftus & Pickrell, 1996), it was 15% in our study. At first sight, these results could be viewed as suggesting that false memories of dreams are more difficult to create than false memories of real-life events. However, to properly interpret these results, it is important to realize that the design used in the present study was based on a misinformation protocol and not a memory creation protocol.

In classical memory creation studies (e.g., Hyman, Husband, & Billings, 1995; Loftus & Pickrell, 1996), the existence of a false event is directly suggested before each recall (corresponding to the second phase of our study) by an authority (i.e., either a relative or the experimenter). The implicit suggestion made to participants in such classical studies is thus that an absence of recall for the false event corresponds to a failure in recall. Moreover, this recall failure is implicitly suggested at each recall interview or until a false memory of the event is reported. Hence, the social pressure to attribute this nonvalid autobiographical construct to a past experience is very high.

By contrast, the context found in traditional misinformation studies (e.g., Loftus & Palmer, 1974) is very different. Participants in these studies are only exposed once to nonvalid or misleading information between the occurrence of the event and the moment of recall and no suggestion is made during recall concerning the validity of the (mis)information. The social pressure to attribute this misleading information to the event itself is thus relatively low. Until now, misinformation studies only succeeded in transforming peripheral elements of a preexisting memory.

As previously mentioned, the present study used a misinformation protocol: (a) participants were exposed to elements of misinformation soon after the target periods of attribution (i.e., the two nights spent at the sleep laboratory), (b) the elements of misinformation were presented informally and not in an authoritative way, and (c) no suggestion was given during the follow-up interviews concerning specific elements that needed to be recalled. Furthermore, the interviewer specified to the participants that he was unfamiliar with the sleep laboratory and the content of the dreams reported during their stay at the lab and simply encouraged them to recall events as best as they could. In addition, the elements of misinformation (i.e., the suggestion of sleep talking and the technician's false dream) did not explicitly suggest the existence of a dream experience. Finally, as opposed to what is usually done in hypnosis-based memory creation studies (e.g., Laurence & Perry, 1983), our hypnotic protocol did not include a memory creation suggestion and it was not used with participants selected on the basis of high levels of hypnotic susceptibility.

Consequently, the 15% of successful memory creation should not be compared with the 20% to 29% reported in memory creation studies, but to the usual lack of memory creation found in classical misinformation studies.

Conclusion and Implications

Taken as a whole, these results allow us to conclude that autobiographical memory is malleable in the context of dream recall and that short but false memories of dreams can be induced in a situation that was previously known to alter only peripheral elements of memories for events. The present results hence demonstrate that individuals to whom a dream is described or who are told that they said something specific while sleeping could, after a few days or weeks, falsely attribute that memory to a personal dream experience and consequently believe that they really experienced the dream in question.

In summary, our data reveal that situations of misinformation can easily elicit false memories of specific dreams in a substantial minority of cases and suggest that misinformation affects the construction of dream memories much like it affects memories of real-life events. These findings thus indicate that a small but nontrivial proportion of people's dream memories may be social constructions resulting from errors of attribution.

These findings have important implications for dream work, dream interpretation, and other types of clinical and social uses of dream narratives. Indeed, people using these techniques need to be aware that the dream reports they are working with could be falsely remembered and their origins misconstrued.

The flow of false memories into memories for dreams could also have an impact on the reliability of autobiographical memories of real-life events given the important role believed to be played by memories of dreams in the production of false autobiographical memories. However, more work is needed to better document this possibility.

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