Influence on False Memories: Biology, Society, or Both?

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**Introduction**

Of all the structures of the human body, the brain is often seen as the most mysterious. Concepts like memories, dreams, and the subconscious have been the subject of endless research and received many cultural interpretations. Various civilizations have strived to understand the mind, and unlock its deepest secrets, seeking everything from internal peace to immortality. Descendants have been taught to remember the great deeds of their ancestors, and the horrific deeds of their enemies. The very understanding of human lives is built on memory. But while recalling the past may be part of human nature, things are much less clear when it comes to remembering what never was. This bizarre phenomenon, commonly known as a false memory, is still a subject of debate in the scientific community, fueling much scholarly research and experiments. Though their exact causes are still to be determined, false memories seem to be influenced by things like gender, semantic meaning, age, psychological trauma, and the ability to plan future tasks.

**False Memories: Definition and Biological Factors**

**Natural Biological Factors**

To unlock the secret behind false memories, their nature, including biological aspects, must first be understood. Dang et al (2020), a team of researchers writing for the *Journal of Pacific Rim Psychology*, define false memory as “the phenomenon that people recall or recognize things that did not actually happen” (para.1). For the context of their research, they divide false memory into suggestive, which is caused by incorrect information from outside sources, and spontaneous, occurring due to internal factors of the individual person (Brainerd & Pool, 1997, as cited in Dang et al, 2020). Based on this knowledge, the team conducted an experiment aimed at determining the connection between a person’s age, and their rate of false memories. After having participants from diverse age groups complete several visual memory tasks, and be tested on them, Dang et al (2020) concluded that age did have a significant impact on misremembering. Their results showed a lower tendency in children to develop false memories, and a bigger such tendency in adults (Dang et al, 2020). The discovery is certainly a significant one, as it offers powerful evidence for the influence of biological components on false memories.

The implications of the research above are further supported by the work of Spets et al (2021), who, documenting their findings in an article for *Neuroimage: Reports*, argue that another major influence on false memories is gender. Citing prior studies and experiment results, they claim that “the brain regions mediating true and false memories are not completely overlapping” (Spets et al, 2021, para.2), and that they differ between females and males. This could mean that not only the frequency, but also the nature of false memories is different between men and women. The team decided to test their hypothesis through practical means. Instructing representatives from the two genders to memorize shapes, and testing their memory, the scientists concluded that “Males, for example, displayed more activity in the [precuneus](https://www-sciencedirect-com.ezproxy.umgc.edu/topics/neuroscience/precuneus), posterior cingulate cortex, and parietooccipital sulcus than females. Notably, the precuneus and the posterior cingulate cortex are associated with the superior false memory network” (Spets et al, 2021, Section 4.2, para.1). Such an outcome, while already impressive enough to confirm the team’s hypothesis, bears even further significance in that the specific areas affected by the experiment were found, reducing the need for guesswork. More intense female activity was noted in other areas of the brain as well, such as the hippocampus (Spets et al, 2021). The areas quoted above are all, in some capacity, involved with false memories. The results recorded tie the findings of both Dang et al (2020) and Spets et al (2021) with an intriguing common thread. Both studies indicate that false memories are influenced by two biological, non-environmental factors, a conclusion critical for the scientific community. Analyzing the biology of false memories can open doors to understanding their causes, and even potentially aid in their prevention.

**Medication: An induced factor.**

Researchers like Dang et al (2020) and Spets et al (2021) examine the false memory phenomenon through influencing factors in the human body, and their results have already been quite intriguing. However, it is significant to note that an important part of human biology are the chemical processes of the organism. And when this is taken into account, the following question arises: How would false memories be influenced by a human-induced, pharmacological intervention into its chemistry? Research addressing this issue has been undertaken by Kloft et al (2022), documented for *European Neuropsychopharmacology.* The team tested the effects of a drug called 3,4-Methylenedioxymethamphetamine (MDMA), often used for both medical and recreational purposes, on false recognition. The organizers recruited 61 participants for their study, all having previous experience with the drug. Before being subjected to testing, the group did not use any drugs for a week, and did not drink any alcohol for 24 hours. Female participants were required to have a negative pregnancy test. Unlike Dang et al (2020) or Spets et al (2021), Kloft et al (2022) used medical means in their experiment, as, on different test days, participants received a 75 mg dose of MDMA, and a dose of placebo. Once the drug took maximum effect, they were subjected to various memory tests, the results of which showed an impairment of true recognition both when under MDMA influence, and a week after that, when the participants met completely sober. Verbal memory impairment was also noted. Despite such findings, the study concluded that the said effects of MDMA were too little and vague to make significant conclusions about whether MDMA affects memory, as well as that they may have been biased by other factors. As such, it can be said that the few discoveries made by Kloft et al (2022) certainly provide good insight on medication-induced false memories, but, because of limited direct proof, the topic needs to be further examined in the future.

**Social Influence on False Memories**

**Semantic Meanings and Everyday Tasks**

While exploration of the subject has certainly benefited from the above discoveries, they are not the definitive answer. Going beyond biology, some research suggests that the triggers for false memories come from one’s immediate surroundings. For instance, Alakbarova et al (2021), writing for *Memory & Cognition*, hypothesized that the presence of a specific meaning (semantic context) in objects or sentences increases the likelihood of incorrect identification, resulting in false memories. Their theory was tested by using a themed list and showing participants sentences created using words from that list. Some of the sentences had significant meaning, and some did not. The experiment results confirmed the hypothesis, as reading a meaningful sentence made the subject more likely to focus on the meaning itself, rather than the images that the sentence may conjure (Alakbarova et al, 2021). Consequently, this would mean that human memory functions to store meaningful, valuable information, explaining the tendency of people to best remember important moments of their lives.

Links between everyday human surroundings and memory errors, like the one above, are further explored in another study, albeit with a different approach. While Alakbarova et al (2021) focused more on connecting memory and meaning, the experiments by research team Cohen et al (2020), described in the *Journal of Applied Research in Memory and Cognition*, shed light on the relationship between memories and tasks. By letting their subjects play the board game *Taboo*, they discovered that individuals have less of a chance to develop false memories about a future task that they still need to complete, than a future task which has been cancelled (Cohen et al, 2020). Therefore, unlike the research by Alakbarova et al (2021), where focusing on the meaning of something created false memories, the project by Cohen et al (2020) showed an increase in memory clarity with a “meaningful” future task, perhaps enhanced by the feeling of responsibility for completing it. The discoveries of these two studies contribute to a significant general conclusion: Whether influenced by biology or society, the human brain focuses on what is deemed more important, and stores information selectively. The possibility of a false memory can therefore be reduced if an individual pays close attention to their surroundings and situation.

**Language: Native tongues, foreign tongue, and false memories**

The meaning of images, and participation in board games, are certainly big parts of social life. Other aspects, however, are much more deeply engraved into it, in the sense that they had wider applications in the formation of humans as social beings. One of such factors is language. Being used to describe surroundings, hold conversations, and recall the past, language has significant ties with memories, including false ones. Those ties, and their effects, are investigated in an article by Dolgoarshinnaia and Martin-Luengo (2021). Writing for *Frontiers in Psychology*, the scientists examine the correlation between multilingualism, or the ability to speak more than one language, and false recognition. Their main hypothesis was that errors in memory experienced by monolinguals were of a different nature than those experienced by bilinguals. A total of 70 volunteers were recruited for the experiment, which involved watching a clip of a car robbery, performing distracting tasks, and then listening to mock “witness reports” of the depicted event. The reports were read in both English and Russian, and contained five pieces of misinformation. Finally, the participants were tested on their confidence level of whether a particular detail was mentioned in the English or Russian report, or hadn’t been mentioned at all. In contrast to Spets et al (2021) and Dang et al (2020), Dolgoarshinnaia and Martin-Luengo (2022) had their hypothesis partially disproved, as their results showed no significant difference in perceiving misinformation between the two languages. They did, however, reach the conclusion that the difference in memory errors between monolinguals and bilinguals may be the result of each language affecting memory monitoring differently in each group. Such a fact is undoubtedly useful, as it not only shows that false memories differ between languages, but lays the groundwork for potential future studies that may expand on the one above.

An earlier, more extensive, and perhaps more successful study on language influencing false memories was conducted by Arndt and Soledad Beato (2017). Publishing for the *Journal of Memory and Language*, the pair describes a series of 3 experiments conducted to, once again, determine the connection between false memories and knowledge of multiple languages. Using what is known as the Deese-Roediger-McDermott (DRM) paradigm, the experiments unfolded as such: Experiment 1 was directed at native English-speakers who studied Spanish as their second language. The 28 participants were demonstrated a series of words (some in English, others in Spanish) on a computer, belonging to six themes for each language. After this presentation, all participants were tested on their memory regarding the words. They were especially asked to recall special “critical words” in their test. The result of the experiment was a more frequent false memory pattern when it came to English, rather than Spanish, critical words. While this initially appears to imply that one is more focused when it comes to a foreign language rather than their native one, Experiment 2 has a completely contradictory outcome. In its case, fifteen students, having undergone almost the same procedure (but with Spanish instructions), demonstrated a bigger false memory rate in English (their second language), than in Spanish (their native language). Experiment 3 demonstrated an even more baffling result, with those students who were more proficient in English as a second language having higher false memory rates than those who were less proficient. Taken together, the results of all 3 experiments indicate a higher false memory rate for the languages that the students were most proficient in, and a higher false memory rate for those with greater proficiency in their second language. Thus, unlike the previous, uncertain study by Dolgoarshinnaia and Martin-Luengo (2022), Arndt and Soledad Beato (2017) arrived at a clearer conclusion: When more proficient at a certain language, an individual is aware of more concepts and details, therefore giving more ground for false memories to form. This gives a very useful perspective to the topic, as, unlike Alakbarova et al (2021) and Cohen et al (2020), which concerned social impact in general, this study examined a factor that may vary between individuals.

**Psychological Trauma and False Memories**

As demonstrated by the conclusions above, both biological factors, and everyday situations, can lead to the formation of false memories. But what about uncommon situations? As shown by the results of several studies, experiencing an unpredictable, shocking, traumatic event can lead to misremembering its details. The complicated relationship between false memory and trauma has been explored for several decades. In as early as 2000, in the *Journal of Psychopathology and Clinical Science*, Zoellner et al said the conclusions of their study about Post-Traumatic-Stress-Disorder (PTSD), in which several word recognition tests were involved, “lend partial support to our hypothesis that individuals with PTSD would be more susceptible to falsely recalling and recognizing words that were never presented.” (Zoellner, 2000). The team found that subjects with both PTSD and other traumas were more prone to erroneously identify certain words, implying that their condition had affected their recognition abilities. While these were already significant results, much work was still to be done, and the evolution of research methods over the years allowed for a more in-depth exploration of the topic. For instance, in *Applied Cognitive Psychology*, Oulton et al (2016) present their research on the repression of traumatic thoughts, and its influence on the recollection of traumatic events. The approach by Oulton et al (2016) was much closer in its nature to Spets et al (2021), than Zoellner et al (2000), in that it used a visual medium (film clips), rather than word lists, for the purposes of their study. The team intentionally chose a film depicting a disturbing car crash, and surveyed participants on their reactions to it over a 24-hour period. In that timespan, the participants were split into three groups. One was instructed to monitor their thoughts related to the film, another was asked to both monitor their thoughts and suppress them, and a third group was asked to simply think freely (Oulton et al, 2016). After this, participants were shown clips from the film again, along with some that they had never seen before, and some that they had, but were now missing. The results showed that the subjects recognized 32.99% of the new clips as something that was previously shown, and were totally certain of that fact. It was also concluded that, unlike what the researchers hypothesized, thought suppression of a traumatic event did not cause more intense recollections of it later (Oulton et al, 2016). Therefore, in addition to being caused by everyday situations, as shown by the findings of scientists in the previous section, memory distortion can also occur in relation to spontaneous, traumatic, and unexpected events. Results of studies like the ones by Oulton et al (2016) and Zoellner et al (2000) can offer better insight into conditions such as PTSD, potentially pointing to better treatment options.

The findings by Oulton et al (2016), however, are far from the final attempt at researching the false memories-trauma relationship. Reporting for the *British Journal of Developmental Psychology*, Otgaar et al (2017) investigate the presence of false memories in children that have been treated badly as opposed to children that haven’t. In fact, the team takes a similar approach to Dang et al (2020), examining suggestion-induced and spontaneous memory. In their research, Otgaar et al (2017) presented children with several lists of words, including neutral and negative words. This was done by using a Deese-Roediger-McDermott false memory paradigm. The scientists also used a video depicting a bank robbery, after which they intentionally gave the children suggestive misinformation about that robbery (Otgaar et al, 2017). The results of the study demonstrated that, in children who were maltreated, the level of negative spontaneous false memories was higher, whereas suggestion-induced false memories were lower (Otgaar et al, 2017). This would mean that, although trauma and maltreatment certainly affect one’s false memory rate, that level of influence depends on the type of the memory itself. Overall, the stress of traumatic situations significantly increases the likelihood of false memories.

Despite being conducted for the common purpose of determining the mechanisms behind false memories, the studies of the people above have some significant differences between them. More precisely, they each focus on a different *category* of memory. Spets et al (2021), for example, conducted their gender-related research with emphasis on long-term and spatial memories. Both Dang et al (2020) and Otgaar et al (2017), on the other hand, divide the concept of false memories into spontaneous and suggestive (Dang et al, 2020, Otgaar et al, 2017). Cohen et al (2020) discuss the concept of prospective memory, Kloft et al (2022) briefly mention verbal memory, while neither Alakbarova et al (2021), Oulton et al (2016), or others, seem to have a specific focus. Because of such differences in their approach, the results of their research cannot be collectively taken as evidence for the explanation or origin of the false memory phenomenon but can rather be viewed as different perspectives on the same topic. Furthermore, there isn’t even a clear-cut border between the biological and social influences on false memories. For instance, while examining age as a factor, Dang et al (2020) still touched on concepts like misinformation (suggestive memory), and employed visuals in their experiments, both of which are immediate part of the society a person lives in. Spets et al (2021) used shapes (a common everyday concept) in their gender research, and the disregard for biological factors could have been a potential bias to the social and situation-focused studies. Not to mention, participants of the biology-focused studies, including the MDMA-influenced group, may have had psychological traumas unknown to the researchers, which may have contributed to their false memory rate. Therefore, however different the studies might be, it was impossible for them to completely avoid common elements, proving that one factor never works without the other.

**Conclusion**

Just like about any scientific topic, false memories have not yet been completely understood. And just like with so many other things, humanity keeps on trying. It seems the human brain just isn’t willing to give up its secrets so easily, not offering any visible clues to what it hides. Unlike chemistry or biology, where it is possible to touch, view, and visually observe results, studying memory only allows to make conclusions based on frequencies of the unseen. What’s more, invisible factors must constantly be considered for the data to remain accurate. And yet, despite the difficulties, tiny rays of hope occasionally do come through. Quick glimpses of how the brain works, or what it depends on, sometimes surface. They do so in the form of studies like the one by Dang et al (2020), exploring the false memory-gender relationship, or Arndt and Soledad Beato (2017), seeking the connections of memory to language. Sometimes, breakthroughs occur in the most unexpected moments, like the traumatic events induced by Oulton et al (2016), for the sake of seeing how trauma influences parts of the brain. And all of these things, taken together, can better shape the views on false memories, opening the roads to knowledge. New facts are constantly learned, shifting the world’s understanding of topics like the one discussed here.

But if the results of such research cannot be seen or touched, what are they good for? How are scientists to be sure that their work is worth it? The strength of studies like these seems to lie in their ability to continue. As long as teams like Alakbarova et al (2021) keep digging into the intricate details of the mind, the drive will exist to learn more. As research continues, perspectives grow, and with them, knowledge grows as well. It is this growing knowledge, and increasingly diverse perspectives, that can one day allow scientists to come to a better, more focused understanding of what is known as a false memory.

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