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The false memory syndrome: Experimental studies and comparison to confabulations

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ABSTRACT

False memories, or recollections that are factually incorrect but strongly believed, remain a source of confusion for both psychiatrists and neurologists. We propose model for false memories based on recent experimental investigations, particularly when analyzed in comparison to confabulations, which are the equivalent of false memories from neurological disease. Studies using the Deese/Roedinger–McDermott experimental paradigm indicate that false memories are associated with the need for complete and integrated memories, self-relevancy, imagination and wish fulfillment, familiarity, emotional facilitation, suggestibility, and sexual content. In comparison, confabulations are associated with the same factors except for emotional facilitation, suggestibility, and sexual content. Both false memories and confabulations have an abnormal sense of certainty for their recollections, and neuroanatomical findings implicate decreased activity in the ventromedial frontal lobe in this certainty. In summary, recent studies of false memories in comparison to confabulations support a model of false memories as internally-generated but suggestible and emotionally-facilitated fantasies or impulses, rather than repressed memories of real events. Furthermore, like confabulations, in order for false memories to occur there must be an attenuation of the normal, nonconscious, right frontal “doubt tag” regarding their certainty.

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Introduction

False memories are semantic or autobiographic memories that did not occur. The existence of false memories is a challenge not only to our self-perceived ability to record truth and report it according to some objective standard, but also raises questions of nonconscious motivations. The understanding of false memories is not only important as a window to the nonconscious but can also lead to basic insights into the mechanisms of memory. In fact, a complete picture of memory is unlikely to emerge without a better understanding of the phenomenon of false memories.

For psychiatrists, the nature of false memories has remained controversial since Freud's time. When Freud visited Charcot in 1886, Charcot had already concluded that many of his patients' neurologically inexplicable symptoms and signs were connected to traumatic memories that were not entirely available to consciousness [1]. This view, when combined with his friend Breuer's work with “Anna O”, would germinate in Freud's first major publication, the “Studies in Hysteria” of 1895 [1]. In this work,

he describes the almost uniform assertion, probably made during a state of altered consciousness if not hypnosis, of paternal incest on the part of his young female clients, all of whom disclaimed any conscious awareness of these events. Freud subsequently repudiated the notion that these events had literally occurred. He eventually concluded that the reported “seduction” was the manifestation of imagination and fantasy related to latent infantile sexuality rather than the repressed memory of an actual event.

The “recovered memory” movement that began over three decades ago assumed that the incest described by Freud's patients was real, and that this reality was falsely rejected by Freud. This paved the way for a decade of “uncovering” of memories, whose technique, particularly in children, was fraught with suggestion, and which culminated in bizarre and tragic phenomena such as the McMartin Preschool case of the late 80's in which innocent adults were falsely imprisoned on the basis of children's suggested “memories” of often lurid and theatrical sexual abuse [2]. In the wake of these events, investigators demonstrated that false or altered memories of events, even very traumatic ones, can be endorsed as “real” by otherwise normal people [3–8]. Given certain situations, normal adults have reported false memories or even provide false confessions. We now know that a spectrum of false memories is common, and investigators are beginning to define the mechanisms of false memories in normal individuals, particularly in comparison to neurological patients.

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For neurologists, a potential source of understanding of false memories is confabulation from brain disease. Confabulations are false statements without a conscious effort to deceive occurring in clear consciousness in association with neurological disease [9]. They are “honest lying” as confabulators are unaware of the falsehood of their statements. The most common confabulations are provoked or momentary, simple, or minor errors in content or temporal order often elicited by questions about the past [9–11]. Other, uncommon confabulations are spontaneous, fantastic, grandiose, bizarre, or patently impossible statements [11,12]. Neurological causes of confabulations include Wernicke–Korsakoff’s syndrome, ruptured communicating artery aneurysms especially anterior, strategic diencephalic strokes, traumatic brain injury, herpes and other encephalitides, nicotinic acid deficiency, multiple sclerosis with frontal and parietal lesions, hypoxic-ischemic injury such as from attempted hanging, normal pressure hydrocephalus, and frontotemporal dementia.

Hypothesis/theory

We advance a model of characteristics and underlying mechanisms for false memories. Many recent experimental investigations of this phenomenon in normal people, along with related functional magnetic resonance imaging (fMRI) studies, are clarifying our understanding of the false memory syndrome. Because of the similarities to the neurological phenomena of confabulations, we compare and contrast the findings of these false memory studies with our current understanding of the basis of confabulations. Although the comparison is imperfect, as there can be dissociations between false memories and confabulations [13], this comparison does amplify our ability to logically infer underlying neurobiological aspects of false memories. We propose that the sum of the scientific information indicates an origin of false memories consistent with Freud’s formulation as originating in internally-generated fantasies or impulses, rather than repressed memories of real events. Our model additionally requires a second step. After the false memory is generated, the subject accepts it because of an attenuation of an automatic, nonconscious sense of uncertainty, mediated by the ventromedial prefrontal cortex (VMPFC). What follows is an evaluation of this model in light of current experimental studies on false memories compared to the related neurological phenomena of confabulations.

Evaluation of evidence from false memory experiments

A broadly-accepted experimental paradigm to measure false memory did not emerge until the advent of the Deese/Roedinger–McDermott paradigm (DRM) [14]. DRM experiments demonstrate the pervasiveness of false memories both to prompting and free recall, and allow manipulation of the variables contributing to the phenomenon. In the DRM paradigm, the investigator presents a list of semantically-related items (e.g., bed, rest, pillow, night), followed, after an interval, by a previously non-presented but thematically-related “lure” item (e.g., sleep). These “lures” are often falsely endorsed, embellished, or even freely-recalled. This DRM response occurs in normal people and is influenced by many conditions, including the number of items in the list and their degree of semantic relatedness [15]; attentional distraction and forewarning of the effect [16]; the medium (verbal, visual) in which the information is presented [17]; the age and cognitive status of the subject [18], and nonconscious cognitive factors [5].

The results from recent DRM studies reveal several pertinent factors that promote false memories. We have interpreted and summarized them into seven categories. DRM responses are associated with increased: (1) Need for complete and integrated mem-

ories as reflected in an exaggerated tendency for completion or “filling-in” of incomplete memories and in the inclusion of increased and more coherent context [19–22]. (2) Imagination and fantasy-proneness, wish fulfillment, magical thinking, self-reported anomalies of experience, and vivid imagery schema [8,23–26]. (3) Familiarity including prior exposure and incidental or indirect encoding [3,4,27–31]. (4) Self-relevance measures including autobiographical information and items related to survival [32–34]. (5) Emotional-facilitation from events, pictures, and words in normal and stress situations [6,7,35–42]. (6) Suggestibility or the ability to plant or indoctrinate false memories, such as in false confessions or overheard rumors [43,44]. Finally, in addition to support from the DRM literature [45], there are the previously noted psychoanalytic findings showing an increased sexual content of false memories [46].

In addition to the DRM findings, there are three prominent theories of false memories that need consideration. First of all, memory is constructive in nature so that it sometimes leads to the retrieval of distorted illusory information because of abnormal or biased reconstruction [47]. Memory is recast and actively modified with every retrieval or “reconsolidation” [48], and false memories may be emotionally-facilitated by increasing the storage of “free-floating” memory fragments that are poorly located in time, space, and context. Second, the “Fuzzy-Trace” theory posits different levels of encoding including a less stable “verbatim” level with fast decay and a “gist” level with slow decay [49]. False memories may result from over-endorsement and interpretation of “gist” appropriate items on recall. Third, the Source-Monitoring Theory predicts errors according to the internal versus external source of the encoded memory [50]. Upon recall, a false expectancy of source occurs based on the usual context for that type of memory, resulting in a false source memory, e.g., of an external, versus internally-generated, trace. There are many additional theories of false memories, but these three have support from experimental and neuro-anatomical research.

fMRI studies of false memories point to prefrontal cortex, particularly ventromedial and in the right hemisphere, as involved in false memories. False recognition correlate negatively with grey matter density in prefrontal areas (Brodmann’s areas 9 and 47) [51]. Although the left prefrontal cortex is involved in both true and false memories [52], the processing of false information is associated with stronger activations in the medial prefrontal cortex, an area involved in decoupling in false belief attribution [53]. False recollections result in activations mainly in the right prefrontal cortex [42], and the false recollection rate is much higher for right hemisphere compared to left hemisphere presentations [42]. In contrast, the left prefrontal cortex is activated during pretending to know relative to correct rejection and false recognition [54]. An exception to this laterality may be age-related false memories, which have greater processing in the left ventrolateral prefrontal and superior and lateral temporal areas [18,55]. High-confidence responses for false recognition or false memories are associated with frontoparietal activity and the associated superior longitudinal fasciculus [17,52,56,57]. The right anterior hippocampus is activated during false recognition relative to correct rejection and pretending to know [54]. In contrast, the left medial temporal lobe may contribute to true memories, but not to false memories [52,56]. Electrophysiological studies also indicate that hippocampal and associated mesial temporal lobe activity is more characteristic of true memories than false ones [58,59].

Evaluation of evidence from confabulations

Confabulations usually result from a combination of memory impairment and frontal-executive dysfunction in brain disease

[13,60]. Since confabulations affect remote memory, the memory impairment must involve retrieval mechanisms and reconstructive memory processes [61]. In spontaneous confabulations, however, the memory difficulty goes beyond just a cover up of memory gaps. Moreover, since patients accept confabulations as real, the frontal-executive dysfunction must involve impairment in self-monitoring, which is usually mediated by medial and orbital frontal regions. The frontal executive dysfunction also contributes to the memory impairment through disturbances in the organization for retrieval, temporal ordering of memories, and post-retrieval monitoring of recovered memories [10,62–64].

The results of studies on neurological patients with confabulations parallel the findings on normal subjects on the DRM protocol. We have interpreted and summarized them. Confabulations are associated with increased: (1) need for completion and integration as reflected in the occurrence of completion errors with momentary confabulations and plausible but false answers created to fill in gaps in memory or coherence [10]. (2) Vivid imagination, fantasy-proneness, wish fulfillment, embellishment, and story or myth-telling with spontaneous confabulations, which arise from internally-generated events or ideas and tend to be pleasant and self-enhancing [60,65,66]. (3) Familiarity including prior and incidental exposures is implied in much of the literature, although there is little dedicated research with confabulations [9,12,60,62]. (4) Self-relevance measures including an inability to retrieve autobiographical information systematically in spontaneous confabulations [60,67]. Confabulation serve important functions of self-coherence (coherent self-narrative), self-monitoring (oneself in relation to the world), or self-enhancement [67]. In contrast to false memories, there is little or no information supporting emotion-facilitation, suggestibility, or a sexual theme in confabulations.

In addition to these characteristics, there are three prominent theories of confabulations that further clarify these findings. First of all, confabulations may result from inability to suppress irrelevant memory traces or to keep from “uploading” anticipated memories [68]. They fail in the extinction of previously appropriate anticipations [11], probably resulting in confusion of untrue memories with true memories [12]. Second, confabulations, like false memories, may be due to source monitoring deficits in context, reality, or time leading to inability to correctly bind memory traces and the incorrect mixing of unrelated memory traces [50]. Source monitoring deficits impair the ability to distinguish real memories from internally-generated thoughts or imaged events with a tendency to identify imagined events as externally driven [10,60]. Third, confabulations may result from deficient strategic retrieval or deficits in the control of memory retrieval [64,69]. In addition to the retrieval of incorrect “memories”, there is a disordered ability to accurately evaluate the retrieved memories which involves an intuitive, fast, automatic “feeling of rightness”, followed, if necessary, by a conscious, slow, effortful checking process [10,61,70]. In confabulation, there may be an abnormal feeling of rightness, or the absence of a “doubt tag” [70], resulting in an incorrect certainty or conviction and failure to subsequently perform a conscious checking process for the veracity of the confabulation [61,63,70].

Similar to false memories, neuroanatomical studies of confabulation have pointed to prefrontal regions of involvement. These studies have shown orbital and medial frontal cortical disease [71–73]. VMPFC lesions result in disturbed source monitoring with temporal context and content confusions [72]. The VMPFC is particularly involved in the retrieval and production of a narrative and in the feeling of rightness [64]. Failure of orbitofrontal cortex (OFC) mechanisms may additionally result in an inability to suppress the interference of memories that do not pertain to ongoing reality [74]. Spontaneous confabulations may require damage to both the VMPFC and OFC with a faulty doubt tag and disinhibition

[10]. Other work has shown that the right ventromedial/orbitofrontal area adds an emotional tag to experience and monitors the appropriateness of decisions [75], whereas, work with split-brain patients has shown that the left hemisphere engages in “storytelling” [76].

Consequences and discussion

Recent interest in false memory, which began in neurology and detoured for many years into psychiatry, has led to studies that can clarify their underlying characteristics, particularly in comparison to confabulations. The DRM model provides a testable paradigm for examining what we now recognize to be a normal degree of false memory creation in normal adults as well as children. The spontaneous generation and embellishment of false responses in the DRM protocol, coupled with the confabulations or the neurological equivalent of false memories, illuminate processes that are unique to false memories. These include emotional facilitation, suggestibility, and sexual content. Similar to confabulations, there is probable attenuation of a right VMPFC doubt tag. Several theories of false memories and confabulations have some validity and cannot be discounted, including impaired reconsolidation of memories, the Fuzzy-Trace focus on the “gist” with dilapidation of the details, source monitoring deficits, failure to suppress irrelevant memory traces, and problems with strategic retrieval.

There are significant similarities between false memories and confabulations. Both false memories and confabulations are facilitated by the need for integrated and complete memories, the familiarity of the material, and the presence of self-relevant or autobiographical content. False memories and spontaneous confabulations tend to have content that is influenced by imagination and fantastic thinking with elaborative characteristics and fanciful personal narratives [12]. The neuroanatomical information regarding false memories and confabulations points to dysfunction in the VMPFC. Other information and lesions implicate the right frontal lobe more than the left in this process [76].

There are significant differences between false memories and confabulations. Emotional-facilitation is prominent in false memories but not confabulations. Emotions may overwhelm or supersede the feelings of uncertainty, or doubt tag, for an incorrect memory. Suggestibility appears to be another factor in false memories but not in confabulations. This could be a factor for confabulations as well, but may not be evident because of the presence of memory impairment. More difficult to explain is the reason why false memories, as opposed to confabulations, tend to drift to sexual themes. Wishful ideations are powerful generators of positive biases in the content of confabulations, but they are usually not associated with lurid sexual content. Freud was in the end struck by the monotonous and stereotyped quality of the sexual content. Moreover, a phenomenon, such as Facilitated Communication where communication in an impaired person may be suggested by subliminal cues from the facilitator [77], has resulted in very similar sexual content. From these observations, it appears that sexual material spontaneously emerges from the nonconscious of normal adults without their knowledge. We must conclude that there is at least some evidence to suggest a broad tendency towards sexuality in the creation of false memories.

The very notion of false memory stands as a challenge to our self-image as rational, veridical reporters of actual events, as human tape recorders or cameras. Add to this the further possibility that what we remember may be emotionally-facilitated or a product not only of suggestion but even of fantasy – fantasy of the most inadmissible sort, unavailable to consciousness – and it is little

wonder that the main currents of memory research have until fairly recently passed it by as something dark. Insights from DRM studies and confabulations in brain disease may be the key to a better understanding of false memories. In turn, such understanding is bound to yield further insights into memory in general. There are potential clinical and legal implications of this model of false memories as well. Finally, there are many implications of this model of false memories for future research including the testing of fantastic thinking and imagination, implanted imaginings as sources of false memory, and the manipulation of the feelings of uncertainty, or doubt tag, during DRM experiments.

Conflict of interest

None declared.

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