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False Memories and Confabulation

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ABSTRACT

In the disciplines of the neurological and psychiatric sciences, false memories are referred to as autobiographic or semantic memories that did not happen (Mendez & Fras [1]). In the case of true memories, they are defined as correctly recalled long term memories (Jeye, Karanian & Slotnick [2]). While confabulations are like false memories but are the result of some type of neurological disorder or illness (Mendez & Fras [1]). This essay will discuss the study of the relationship between false memories and confabulation, to identify which parts of the brain are activated by them separately or together. According to (Jeye, et al. [2]) , false memories routinely are activated by the hippocampus and the anterior/dorsolateral prefrontal cortex (A/DLPFC) .There is also evidence that the A/DLPFC may inhibit the hippocampus , that can expect a negative association in the severity of action in these regions of the brain (Jeye, et al. [2]) .In regard to true memories , it has been demonstrated that they are a result of activity in the hippocampus .It is also important to report that the hippocampus and the A/DLPC have been both implicated in false and true memories (Jeye, et al. [2]) . While it has also been found that false memories and confabulations equally have reduced activity in the ventromedial frontal lobe area of the brain (Mendez & Fras [1]). It is also important to be able to distinguish between false memories, true memories, and confabulation, to explore any clinical implications that can help clinicians who work with patients that have issues with what they remember or do not remember [3-10].

Keywords: False Memories; True Memories; Confabulation

Introduction

The study of false memories, true memories, and confabulation is essential, in order to identify the areas of the brain that are activated. So, the basic structure and function of memory can be identified and explained. In the past, it has been argued that the hippocampus plays a major factor in the recall of true memories (Jeye, et al. [2]). It has also been shown that the hippocampus influences the creation of memories that never happened, which are false memories (Jeya, et al. [2]). In a recent functional magnetic resonance imaging (fMRI) study, it was found that there was overlapping neural action in the hippocampus in both true and false memory (Jeya, et al. [2]). Therefore, there is ample evidence that the hippocampus contributes to the construction of both false and true memories. While confabulations are like false memories but are the result of some type of neurological disorder or illness (Mendez & Fras [1]). It has also been shown that false memories and confabulations equally have reduced activity in the ventromedial frontal lobe area of the brain (Mendez & Fras [1]) (Figure 1).

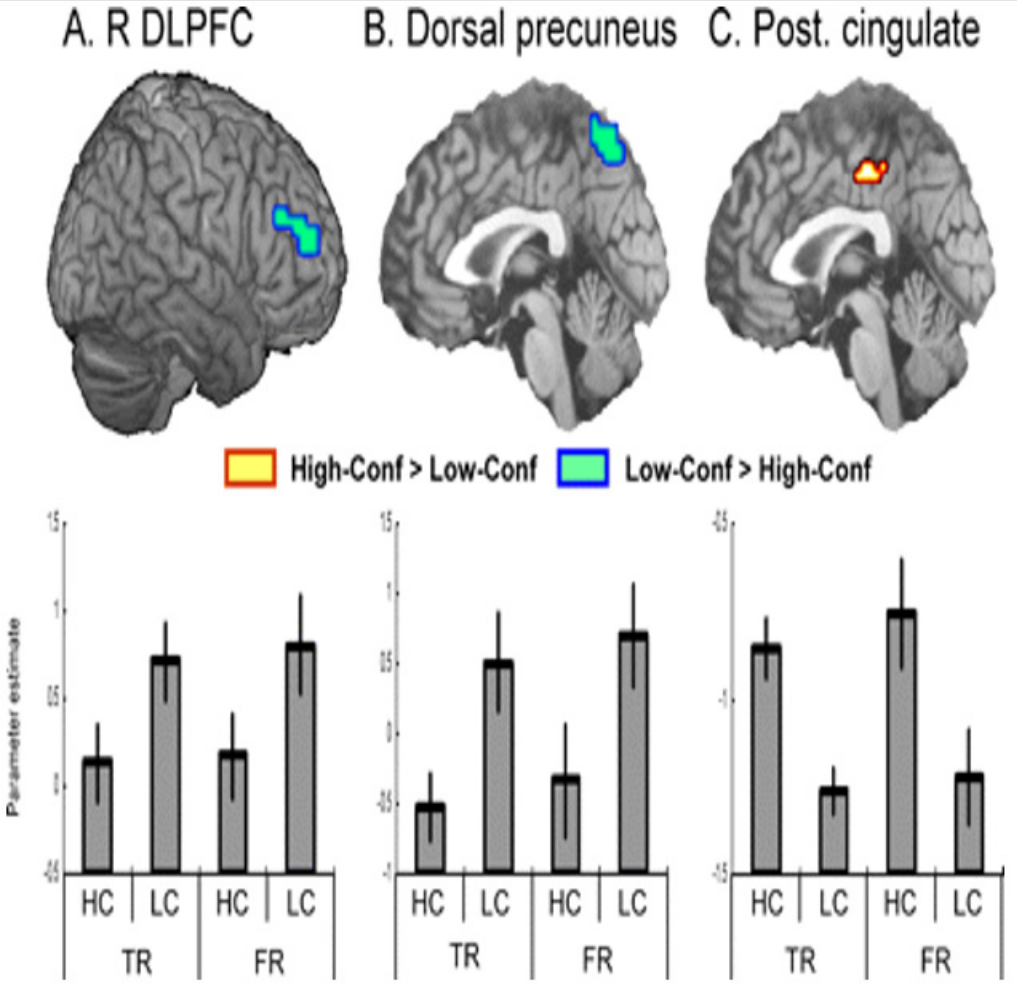

Figure 1: Right (R) dorsolateral/anterior PFC

(A) And dorsal precuneus regions.

(B) Showed greater activity for low- than high-confidence (Conf) response for both true recognition and false recognition. In contrast, posterior (Post.) cingulate region.

(C) Showed greater activity for high- than low-confidence response for both true recognition and false recognition. The bar graphs display mean parameter estimates across all significant voxels. Error bars show ± 1 SE. HC, High confidence; LC, low confidence; TR, true recognition; FR, false recognition.

Note: HIPPOCAMPUS

Source: https://www.jneurosci.org/content/27/45/12190

False Memories

False memories are defined as autobiographic or semantic memories that did not happen (Mendez & Fras, 2010). It has been demonstrated that the A/PLPFC and the hippocampus are activated by false memories (Jeya et al. [2]). According to (Jeya, et al. [2]), the A/PLPFC may inhibit the hippocampus while recalling false memories, that may suggest a positive association with the strength of activity in these areas of the brain when working with subjects. It has been shown that the A/PLPFC may inhibit the hippocampus during memory retrieval, like in the process of motivated forgetting and retrieval-induced forgetting (Jeya, et al. [2]) What these studies suggest is that participants in these studies select either the hippocampus or A/PLPFC while accessing false memories (Jeya, et al. [2]) (Figure 2).

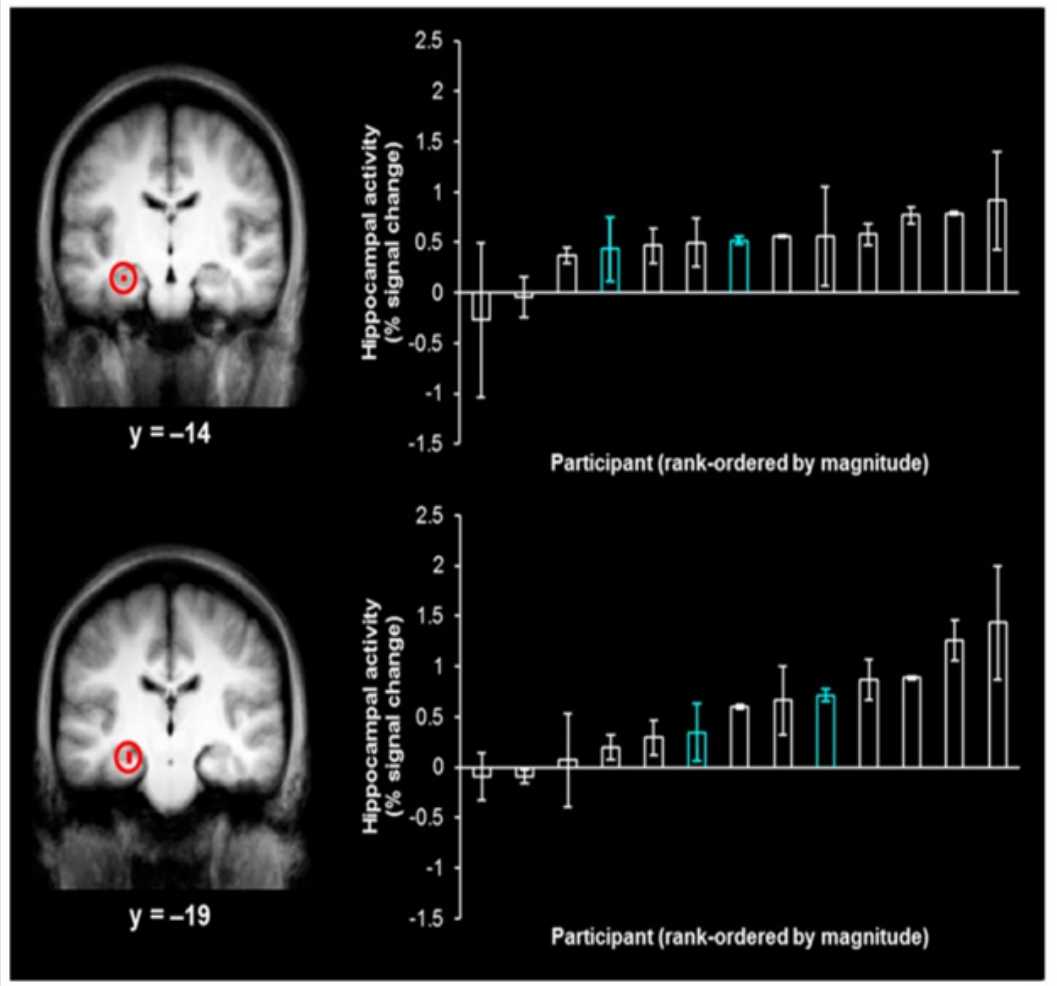

Figure 2: Hippocampal activity associated with true memory for items in the left visual field and the corresponding individual-participant magnitudes of hippocampal activity associated with false memory. Left, hippocampal activations associated with left-hits versus left-misses (circled in red; coronal views). Right, individual-participant magnitudes of activity {percent signal change) associated with false memories {right-'1eft"-"very sure "responses), rank ordered for the lowest to the highest magnitude of activity, corresponding to each hippocampal activation to the left (results from male participants are shown in blue).

Note: HIPPOCAMPUS

Source: file:///C:/Users/rome/Downloads/jeye17_brain_sci.pdf

Confabulations

While experts in neurology and psychiatry study how disorders or maladies of the brain result in confabulations, which are false memories (Mendez & Fras [1]). It is important to explain that confabulations, are not intentional nor is the subject cognizant of trying to mislead anyone (Mendez & Fras [1]). Some routine confabulations are triggered by basic or trivial questions from the subjects past (Mendez & Fras [1]). In fact, some confabulations may be extreme exaggerations, strange, or hard to believe memories of something that may not be possible to have happened (Mendez & Fras [1]). The common neurological or psychiatric causes of confabulation are Wernicke-Korsakoff's syndrome, arterial aneurysms, strategic diencephalic strokes, traumatic brain injury (TBI), herpes, multiple sclerosis, and frontotemporal dementia (Mendez & Fras [1]). It has been widely believed that confabulations are most often the consequence of both memory damage and frontal executive dysfunction in a brain disorder (Mendez & Fras [1]).Since subjects believe that their confabulations are real , the impairment is found in the frontal-executive dysfunction in self-monitoring that is guided by the medial and orbital frontal areas of the brain (Mendez & Fras [1]). In terms of neuroanatomy , it has been shown that confabulation is much like false memories ,which focuses on the prefrontal regions of the brain that are implicated (Mendez & Fras [1]) (Figure 3).

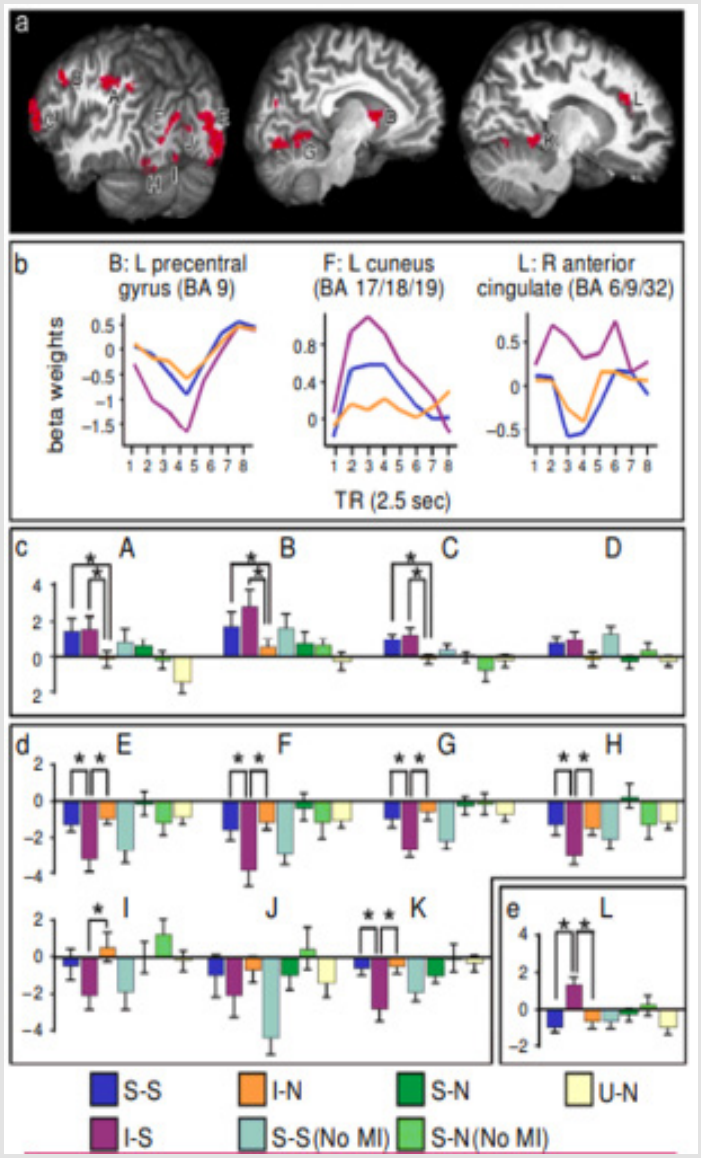

Figure 3: (a and b) Locations and sample hemodynamic responses for regions where activity at test varied among the seven trial types analyzed (there were too few trials in the U–S condition to analyze).

(a) The 12 regions where activity varied as a function of trial type are shown as colored overlays on 3-D renderings of a brain. A: left parietal cortex (BA 7/39/40); B: left precentral gyrus (BA 9); C: left inferior frontal gyrus (BA 10/46); D: left caudate; E: right middle occipital gyrus (BA 18/19); F: left cuneus (BA 17/18/19); G: left lingual gyrus (BA 19); H: left fusiform gyrus (18/19); I: bilateral lingual gyrus (BA 18); J: bilateral cuneus (BA 17/18/27/30); K: right posterior parahippocampal gyrus (BA 30/35/36/37); L: right anterior cingulate gyrus (BA 6/9/32).

(b) Average hemodynamic response functions (sum of beta coefficients vs. image acquisition [TR]) for the three trial types of interest (S–S, I–S, and I–N) are shown for three sample regions (left precentral gyrus, left cuneus, and right anterior cingulate) that demonstrate the patterns of activity observed. (c–e) Activity for all seven trial types analyzed in all 12 functionally defined ROIs. Bars show the mean fMRI response (sum of beta coefficients) across participants, and error bars show the standard errors of the means. Asterisks indicate significant differences in activity between conditions of interest (S–S, I–S, and I–N).

(c) Regions demonstrating the first pattern of activity included A, left parietal cortex; B, left precentral gyrus; C, left inferior frontal gyrus; and D, left caudate.

(d) Regions demonstrating the second pattern of activity included E, right middle occipital gyrus; F, left cuneus; G, left lingual gyrus; H, left fusiform gyrus; I, bilateral lingual gyrus; J, bilateral cuneus; and K, right posterior parahippocampal gyrus.

(e) The third pattern of activity was observed in L, right anterior cingulate gyrus.

Note: DORSAL STRIATUM

Source: https://link.springer.com/content/pdf/10.3758/CABN.3.4.323.pdf

Similarities and Differences in False Memories and Confabulations

Regarding similarities between false memories and confabulations, they both have a necessity for united and comprehensive memories, the awareness of the content, and the inclusion of personal information (Mendez & Fras [1]). In terms of neuroanatomy, both false memories and confabulation appear to have dysfunction in the ventromedial prefrontal cortex (VMPFC) and reduced activity in the ventromedial frontal lobe area of the brain (Mendez & Fras [1]). While some of the differences between false memories and confabulations, are that emotional activity is more influential in false memories than confabulation (Mendez & Fras [1]). Another difference is that subjects may be more open to suggestions for false memories but not for confabulations (Mendez & Fras [1]). It is also important to mention that episodes of confabulation may often include [11-16] (Figures 4-9).

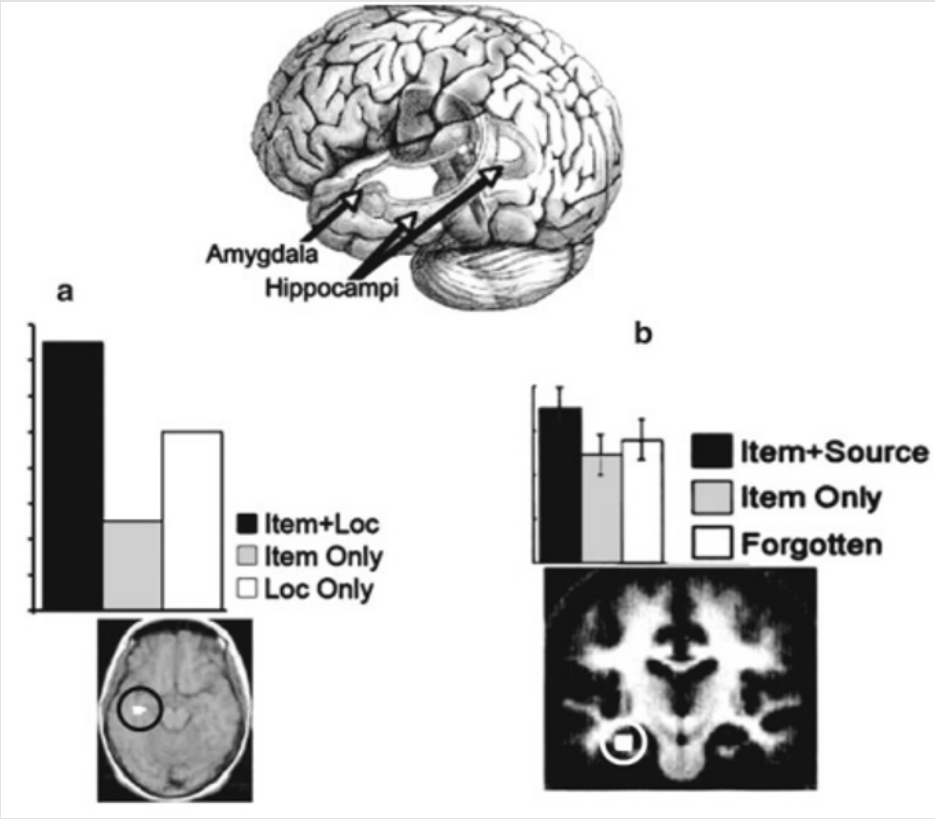

Figure 4: Anterior hippocampus is associated with memory binding:

(a) Greater activity during encoding when people were asked to remember items and locations, compared to just items or locations (Adapted with permission from Mitchell et al., 2000, copyright © 2000 Elsevier Science B.V.).

(b) Greater activity at encoding associated with subsequent accurate source memory, com pared to item memory or items that were forgotten (Adapted with permission from Davachi et al., 2003, copyright © 2003 National Academy of Sciences, U.S.A.). The schematic at the top shows the relationship of the hippocampus and amygdala within the MTL (Adapted with permission from Mitchell et al., 2009).

Note: HIPPOCAMPUS

Source: https://memlab.yale.edu/sites/default/files/files/2011_Johnson-etal_NebraskaChapter.pdf

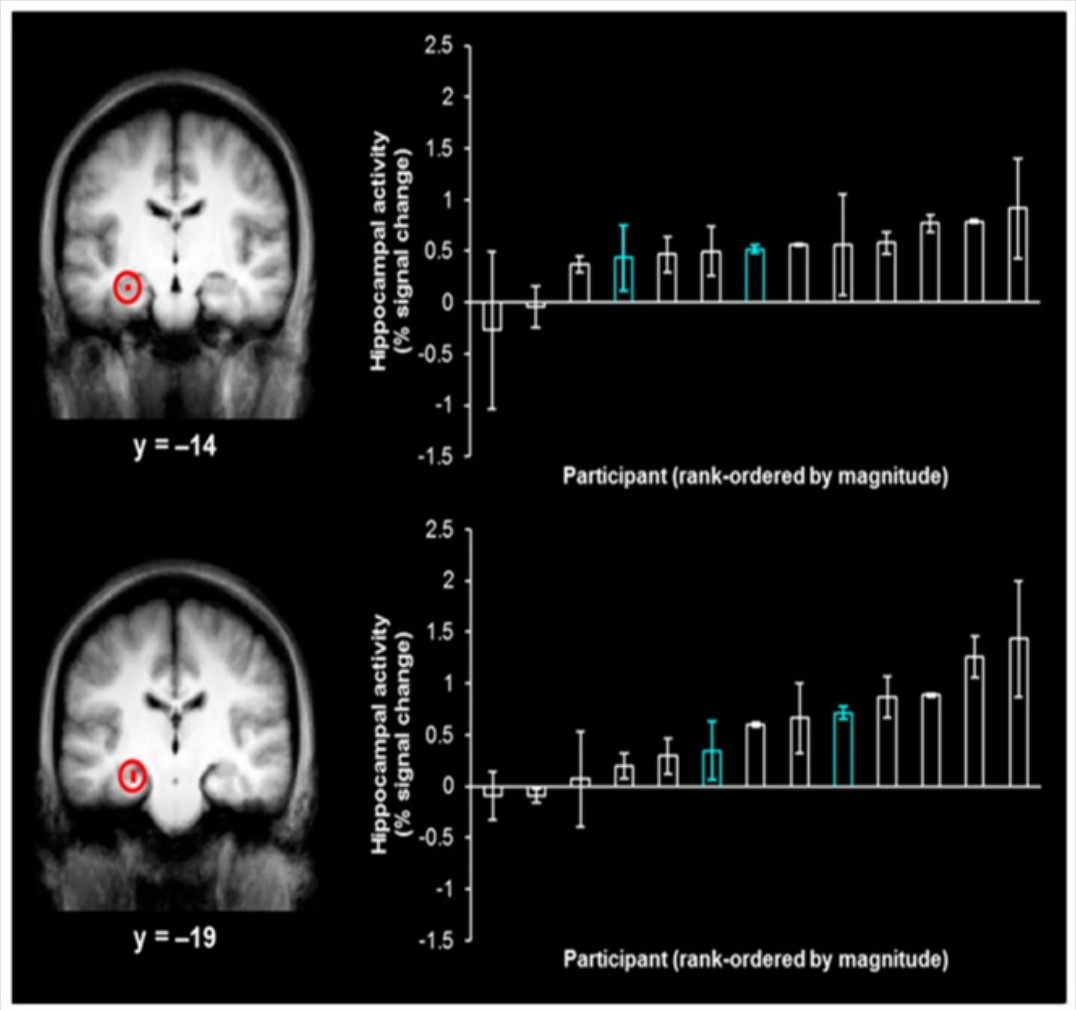

Figure 5: Hippocampal activity associated with true memory for items in the left visual field and the corresponding individual-participant magnitudes of hippocampal activity associated with false memory. Left, hippocampal activations associated with left-hits versus left-misses (circled in red; coronal views). Right, individual-participant magnitudes of activity (percent signal change) associated with false memories (right–"left"– "very sure" responses), rank ordered for the lowest to the highest magnitude of activity, corresponding to each hippocampal activation to the left (results from male participants are shown in blue).

Note: HIPPOCAMPUS

Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5297302/

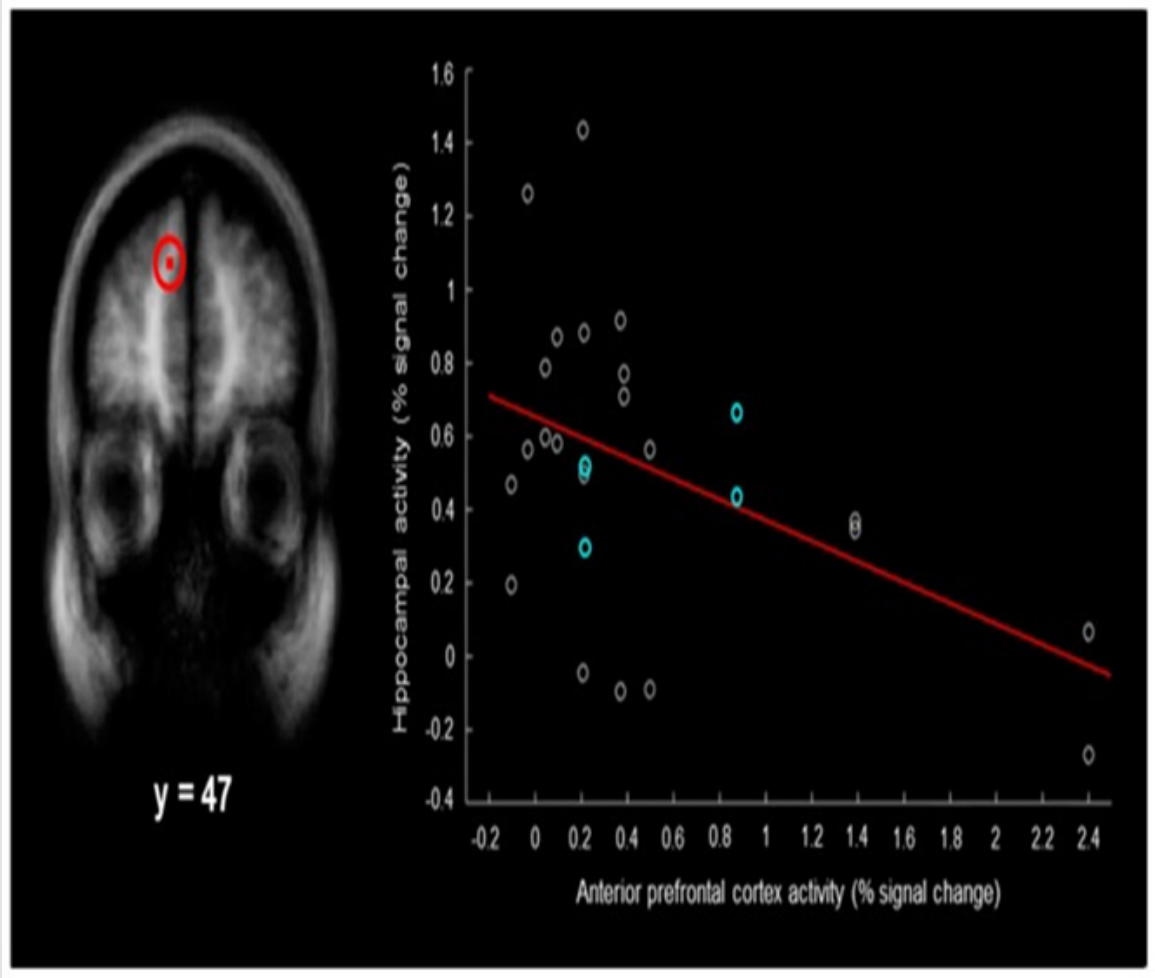

Figure 6: Relationship between the magnitude of spatial memory activity in the left anterior prefrontal cortex and the hippocampus. Left, left anterior prefrontal cortex activity associated with left-hits and left-misses (circled in red; coronal view). Right, for each participant, the magnitude of hippocampal activity associated with false memories as a function of the magnitude of left anterior prefrontal cortex activity associated with false memories (the best-fit line is shown in red; results from male participants are shown in blue).

Note: HIPPOCAMPUS

Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5297302/

Source: https://memlab.yale.edu/sites/default/files/files/2011_Johnson-etal_NebraskaChapter.pdf

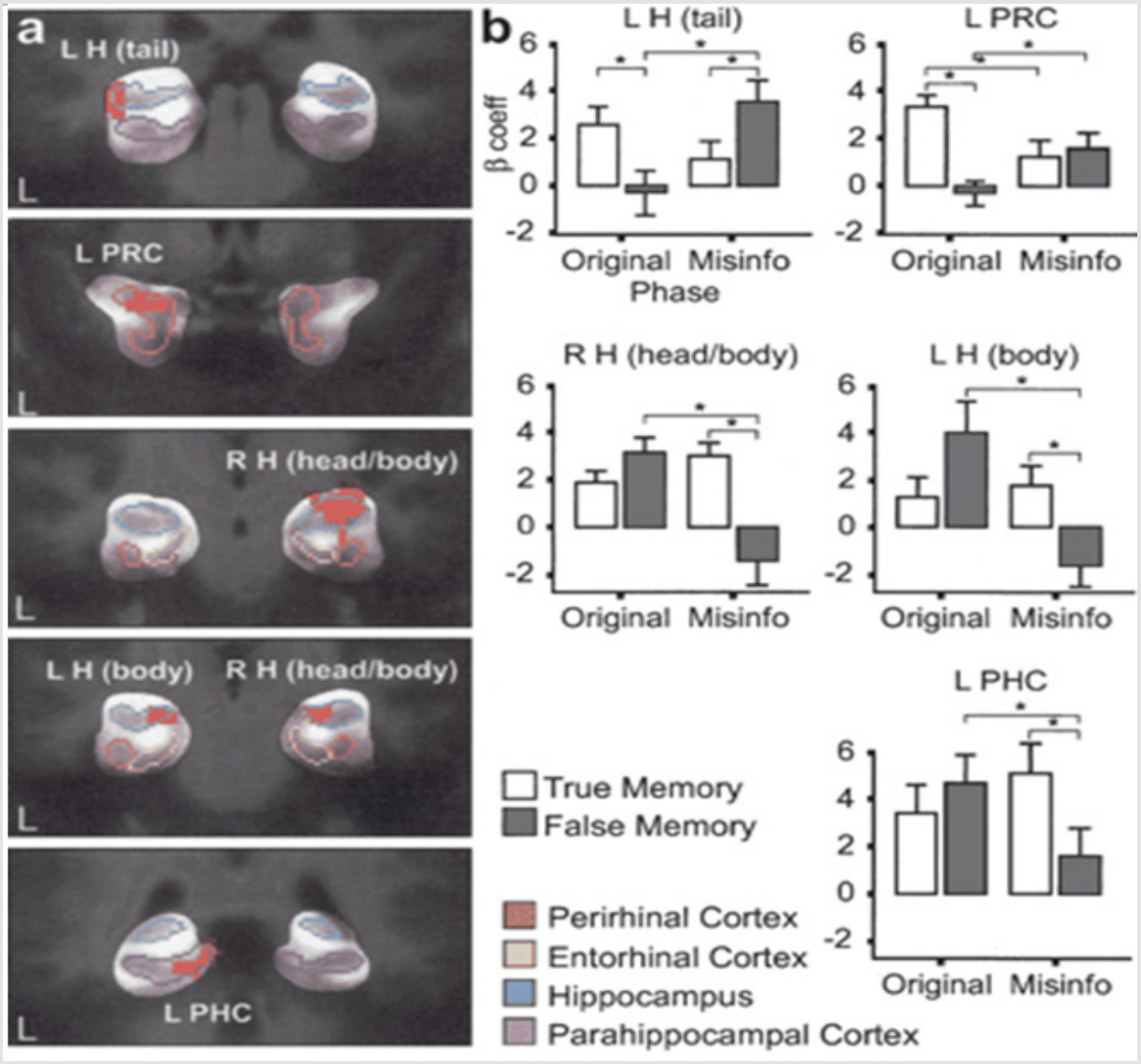

Figure 7: FMRI results from the MTL ROI-AL analysis. Regions that showed significant interactions between type of phase (Original Event or Misinformation) and type of subsequent memory (True or False).

(a) Activity is shown in coronal sections, cropped to show the MTL. Individual components of the MTL are coded by color based on location; blue, hippocampus (H); purple, parahippocampal cortex (PHC); orange, perirhinal cortex (PRC); and yellow, entorhinal cortex.

(b) The bar graphs show mean fMRI responses (sum of β coefficients) across participants. Error bars, SEM. Activity for subsequently true memories is shown in white, and activity for subsequently false memories is shown in gray. (*) Comparisons within and across phases that are statistically reliable. The L H (tail) and L PRC show the first interaction pattern (Dm effect) discussed in the Results section. The R H (head/body), L H (body), and L PHC show the second source encoding pattern discussed in the Results section.

Note: HIPPOCAMPUS

Source: http://learnmem.cshlp.org/content/12/1/3/F3.expansion.html

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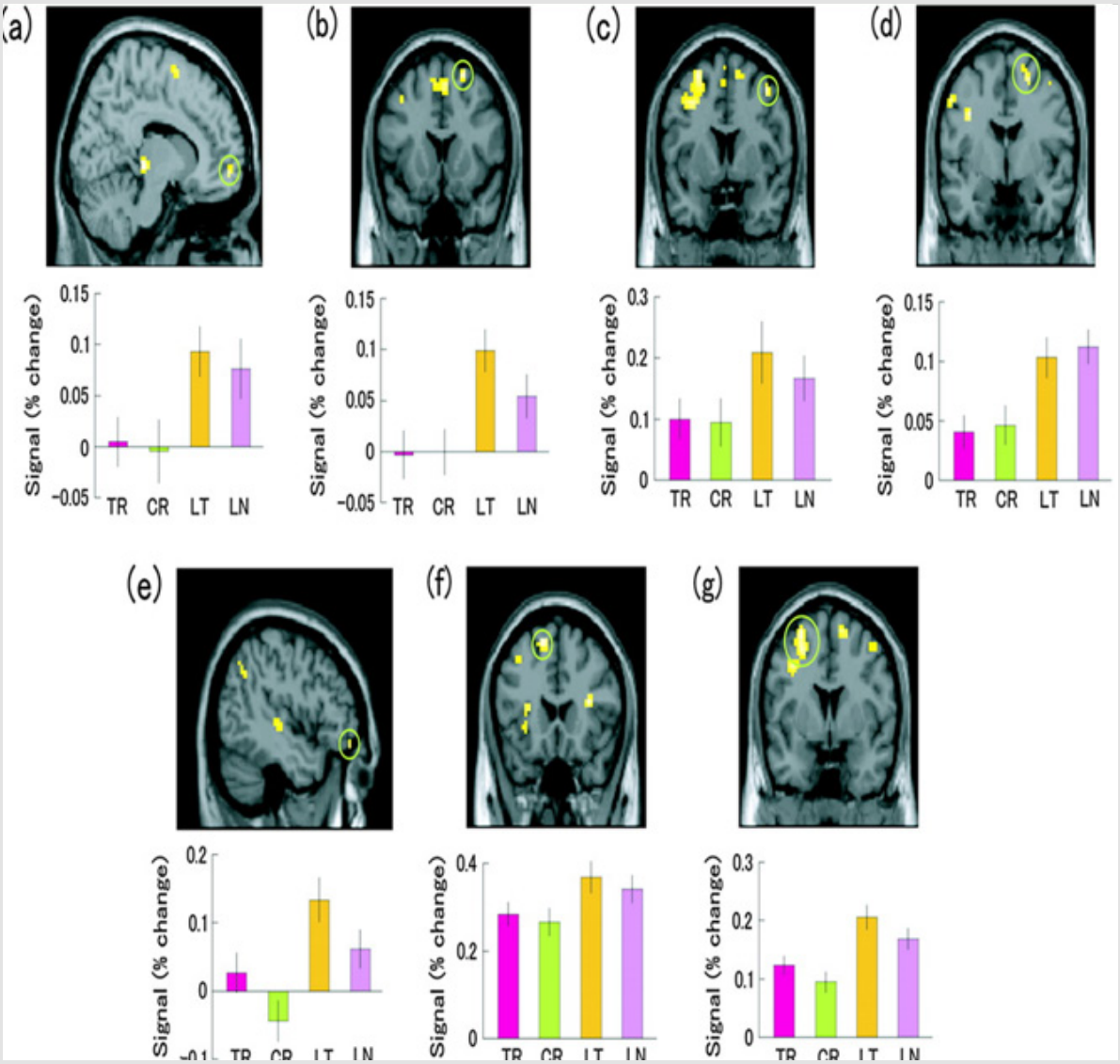

Figure 8: Regions showing greater activation during lying (LT and LN) relative to truth telling (TR and CR). The signal changes of the following 7 activated regions in the frontal lobe are depicted (error bars represent SEM).

(a) Right medial prefrontal cortex [12, 57, −6].

(b) Right superior frontal gyrus [24, 15, 60].

(c) Right middle frontal gyrus [42, 6, 51].

(d) Right superior frontal gyrus [24, −3, 57].

(e) Left inferior frontal gyrus [−45, 48, −15].

(f) Left supplementary motor area [−12, 21, 57].

(g) Left middle frontal gyrus [−27, 3, 60].

TR, true recognition; CR, correct rejection; LT, lying to "True targets" (pretending not to know); LN, lying to "New targets" (pretending to know).

Note: HIPPOCAMPUS

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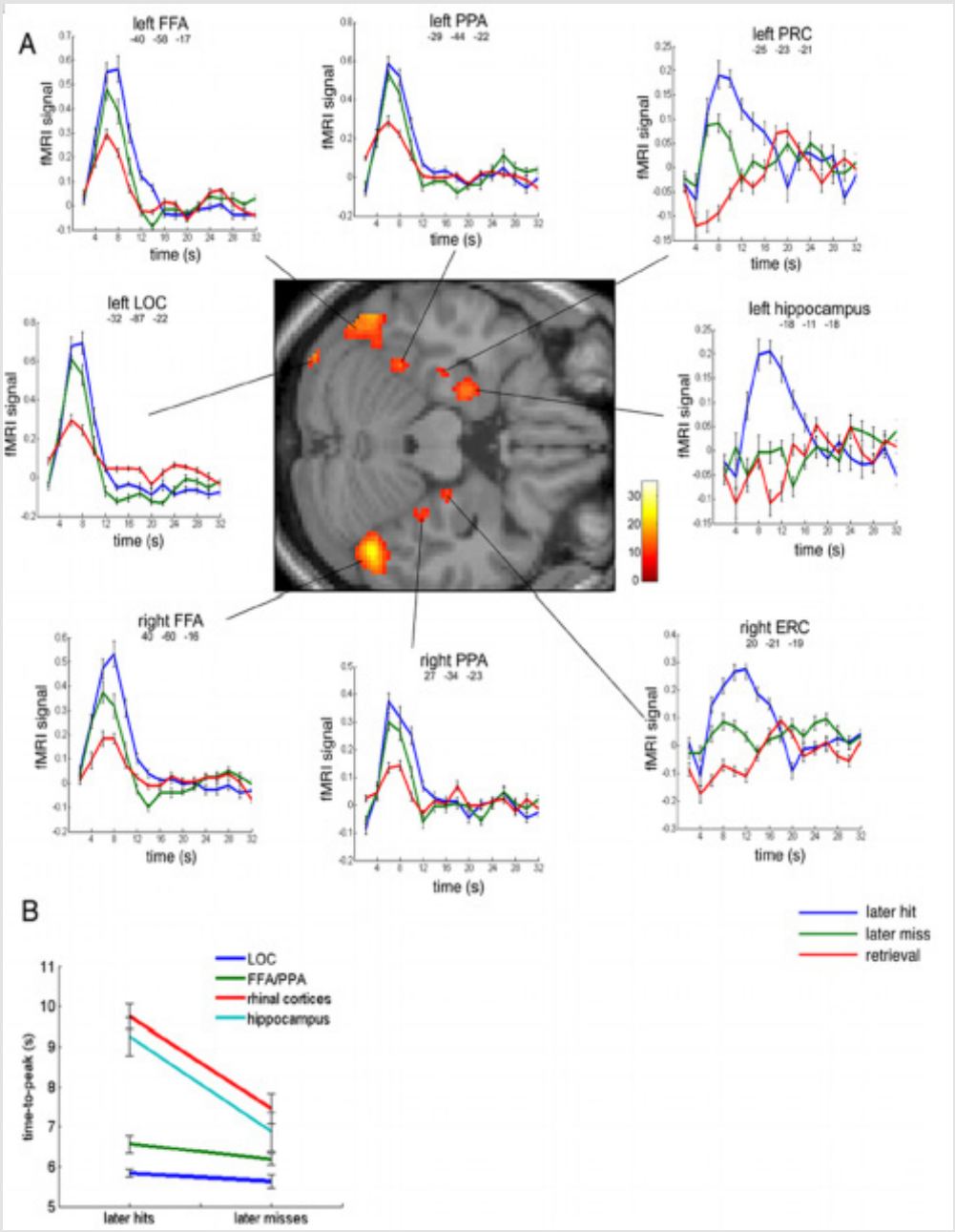

Figure 9: Event-Related fMRI Analyses: Sensory Neocortex and MTL

(A) DM effects (voxels for which the response for successfully encoded pairs was greater than that for unsuccessfully encoded pairs) surviving a statistical threshold of p, 0.001 (uncorrected) are rendered onto a single axial slice of the MNI brain (a single slice was chosen for ease of visualization; voxels shown are not maxima). The scale refers to F values. Each cluster is linked with a black line to a plot of the HRFs for later hits (blue), later misses (green), and unsorted retrieval trials (red). HRFs are averaged across participants; bars are standard errors. Lineplots are titled with the name of the relevant brain region. ERC, entorhinal cortex; PRC, perirhinal cortex. Subtitles indicate the Talairach coordinates of the peak voxel for each significant cluster.

(B) Time-to-peak estimates of the HRF for LOC (blue), FFA/PPA (green), rhinal cortices (red), and hippocampal (cyan) ROIs in each subsequent memory condition. Time-to-peak on the y -axis is in seconds. DOI: 10.1371/journal.pbio. 0040128.g002.

Note: DORSAL STRIATUM

Source: https://www.researchgate.net/figure/Event-Related-fMRI-Analyses-Sensory-Neocortex-and-MTL-A-DM-effects-voxels-for-which_fig2_234063346

Conclusion

It has been reported in this paper that confabulations are like false memories but are the result of some type of neurological disorder or illness like (i.e., Wernicke's-Korsakoff's syndrome, aneurysms traumatic brain injury (TBI), herpes, multiple sclerosis, and frontotemporal dementia) (Mendez & Fras [1]). Even though it has been long recognized that true memories are a result of activity in the hippocampus (Jeya, et al. [2]). It is also important to report that the hippocampus and the A/DLPC have been both implicated in false and true memories (Jeya, et al. [2]). One of the factors that sets the two apart, is that the anterior prefrontal cortex may impede the hippocampus in the duration of false memories and that subjects selected either the anterior prefrontal cortex or the hippocampus during false memories (Jeya, et al. [2]). There is also evidence that the A/DLPFC may inhibit the hippocampus, that can expect a negative association in the severity of action in these regions of the brain (Jeya, et al. [2]). While it has also been found that false memories and confabulations equally have reduced activity in the ventromedial frontal lobe area of the brain (Mendez & Fras [1]).

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