

Research Article

FALSE MEMORY AND OBSESSIVE–COMPULSIVE SYMPTOMS

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Background: *The memory deficit hypothesis has been used to explain the maintenance of repetitive behavior in individuals with obsessive–compulsive disorder; yet the majority of studies focusing on verbal memory show mixed results. These studies primarily evaluated memory accuracy via the inclusion or omission of previously encountered material, as opposed to false recognition (i.e., the inclusion of erroneous material). We evaluated false memories and memory processes in individuals with obsessive–compulsive washing symptoms (OC), individuals matched on depression and anxiety without OC symptoms (D/A), and in nonanxious individuals (NAC). Methods:* Twenty-eight OC, 28 D/A, and 29 NAC individuals read OC-threat relevant, positive, and neutral scenarios and then performed a recognition test. Erroneous recognition of words associated to encoded, but not previously viewed, scenarios were classified as false memories. To evaluate processes underlying memory, participants completed a modified remember/know task to examine whether the OC individuals differed from the other individuals in recollective clarity for false memories of OC-relevant (e.g., germs), positive (e.g., lottery), and neutral (e.g., bread) material. **Results:** *The OC individuals used “know” more than the D/A and NAC individuals for false memories of threat. For veridical memories, the OC individuals used “know” more than the NAC, but not, D/A individuals. Conclusions:* *The greater reliance on “know” (i.e., feelings of familiarity) in general and false threat memories in particular in individuals with OC symptoms may add to feelings of uncertainty for threat-relevant material, which may contribute to compulsive behavior. Depression and Anxiety 26:396–402, 2009. ©2008 Wiley-Liss, Inc.*

Key words: *Threat; Recognition; Deficit; Remember; Know*

INTRODUCTION

Repetitive behaviors such as hand washing or checking are common in obsessive–compulsive disorder (OCD) with as many as 75% of patients primarily exhibiting cleaning and/or checking rituals.^[1] Hence, it has been proposed that memory dysfunction in OCD (e.g., poor episodic recall) serves as a potential mechanism for eliciting and maintaining certain compulsions.^[2–4] However, evidence regarding the specific nature of OCD memory impairment is mixed,^[5] particularly with regard to memory for verbal material. Some studies fail to find a deficit,^[6–8] whereas others do not.^[9,10]

Lack of consistent results challenges the memory deficit hypothesis despite the possibility that contradictory findings could stem from differential sensitivity of paradigms to tap into memory deficits in OCD.

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Rather than persist in the refinement of how true memories differ as a function of OCD status, research has begun to incorporate two related yet divergent issues. One concerns repeated checking consequences on memory. Excessive checking itself can reduce recollective clarity without reducing memory accuracy.^[11–14] Repeated checking is also associated with reduced recollective clarity and memory confidence without concomitant reduction in memory accuracy.^[12,13] Moreover, research suggests that perceived responsibility is associated with memory distrust in OCD patients but not in controls^[15] highlighting the role OCD-related cognitions may play in a cycle of repeated checking and recollection. Although this does not negate the existence of baseline memory differences in OCD, it changes the focus of causality rendering the act of checking itself as responsible for perpetuating the checking cycle and perhaps OC cognitions.

Another line of research suggests conviction of the veracity of one's memories in OCD may be distorted. Valid memories may constitute high standards in OCD resulting in heightened distrust of memory traces^[12, 16] that may contribute to, or result from, repeated checking. These issues raise the possibility that memory accuracy and memory confidence in OCD may be a consequence of repetitive behaviors (i.e., compulsions), rather than a reflection of inherent baseline memory deficits in OCD.

OCD memory research to date has predominantly focused on veridical memory.^[8,17–19] Noticeably, errors of commission (i.e., false memories) have not been adequately explored. Although there is no standard definition of what constitutes a false memory, there is broad agreement that they occur when “people believe that they have experienced an item or event which is actually novel” (p. 392).^[20] False memories in OCD are of particular interest in that differential patterns of false remembering as a function of OC symptoms could provide insight into the cognitive deficits associated with OCD. Additionally, a propensity for heightened false memories in OCD would be relevant from a therapeutic perspective if one accepts the premise that false beliefs and misconceptions founded on false memories may contribute to OCD.

False memory research shows qualitative differences between true and false memories. For example, false memory items have been shown to contain less auditory detail and fewer remembered reactions and feelings than true memories.^[21] One way of investigating memory processes that may contribute to false memories is the remember/know paradigm.^[22] This procedure distinguishes memories based upon familiarity (“know”) from more detailed recollection (“remember”). Although not without controversy,¹

remember/know responses are functionally dissociable^[25] and a number of false memory researchers have used this paradigm to examine the differential contribution of recollection and familiarity underlying false and veridical memories.^[21, 27–31]

An advantage of the paradigm is its ability to examine the differences in memory processes even when absolute levels of true memories do not differ.^[22] If memories differ in terms of their recollective clarity, such that they are based on familiarity and not detailed recollection, an increase in false memories may develop, as individuals will be impaired in their ability to differentiate between true and false memories at test.^[32,33] It is thus possible for false memories to be enhanced in individuals with OCD in the absence of absolute levels of true memory differences. Therefore, false memories may serve as a more sensitive way of detecting memory deficits in different populations than typical recall tasks.

This study evaluated false memories in individuals with OC washing symptoms (OC group). We hypothesized that the OC group would exhibit more false memories for threat than anxious and nonanxious control groups. This is based on research showing memory errors may be exacerbated for information related to one's interests.^[34,35] One explanation for this finding is based on a network model—namely, concepts related to that area of interest are strengthened, such that when one concept is activated, a nonpresented but associated concept is also activated.^[36]

Extrapolating this hypothesis to OCD, preoccupation for threat may consequently strengthen threat concepts in an enhanced associative network that is activated when threat is processed. Indirect evidence of a network based on such preoccupation includes data, showing individuals with OCD are quick to detect threat-relevant information,^[37] have difficulty forgetting such information,^[38,39] and have memory bias for threat-relevant material.^[8,19] Greater impairment for forgetting OCD-relevant words^[38,39] and greater memory bias for threat^[8,19] in OCD compared with anxious and nonanxious controls suggests a well-elaborated, personally relevant network.

We also predicted that the OC group, relative to the other groups, would report more “know” than “remember” responses for falsely recognized threat words and veridical recognition. This is based on research showing individuals with OCD prefer their memories be more vivid than they are^[16] and evidence that repeated checking itself increases “know” responses for accurate memories.^[11–13]

To explore our hypotheses that individuals with OC washing symptoms will exhibit more false memories for threat than individuals without OC symptoms and report more “know” responses for false and veridical memories, college students with and without OC washing symptoms were presented with OC threat-relevant scenarios, positive scenarios, and neutral

¹The remember/know procedure assumes that detailed recollection and familiarity are mutually exclusive consequently leading researchers to criticize its validity^[23, 24] due to the potential interdependence of remember and know responses.

scenarios that comprised emotionally valenced target words and lures.

METHODS

PARTICIPANTS

Eighty-five University of Georgia students consented to participate for partial course credit. We used the Obsessive Compulsive Inventory (OCI),^[40] Beck Depression Inventory (BDI),^[41] and the trait version of Spielberger State-Trait Anxiety Inventory (STAI)^[42] to classify participants into those who: (1) scored high on the OCI washing subscale (“OC group”, $n = 28$); (2) scored low on the OCI measure but matched to the OCI group on depression and general anxiety (“D/A group”; $n = 28$); and (3) scored low on all measures (“NAC group”; $n = 29$). A cutoff score of 8 on the OCI washing subscale was used for the OC group, which mean subscale score ($M = 15.5$) was similar to a treatment-seeking OCD sample ($M = 11.2$)^[40] See Table 1.

Groups differed on washing symptoms [$F(2, 82) = 546.97, P < .001$] and level of depression [$F(2, 82) = 36.5, P < .001$] (BDI), state anxiety [$F(2, 82) = 18.95, P < .001$], and trait anxiety [$F(2, 82) = 19.44, P < .001$] (STAI). Post hoc Bonferroni corrections at α level .05 showed OC and D/A groups were significantly more depressed and anxious than the NAC group. The OC and D/A groups were similar in state anxiety, trait anxiety, and depression but differed on OC symptom levels.

MATERIALS

Two equivalent sets of 13 scenarios were constructed. Each set contained 5 OCD-relevant, 4 positive and 4 negative scenarios. A different group of 88 participants, selected at random, rated these scenarios on a -3 to $+3$ Likert scale. OC threatening scenarios were rated as more negative than neutral scenarios and more negative than positive scenarios.² (Target words and scenarios are available from the authors upon request.) In each set, there were 39 (13 scenarios \times 3 words) target words matched on frequency of word use.^[43] Sets were counterbalanced such that half of the participants from each group saw only one set of scenarios for encoding. For recognition, the combined set of 78 target words was presented.

PROCEDURE

Level of emotionality for 13 scenarios was rated and participants were asked to remember as many words as possible for a later recognition task. Subsequently, participants performed an unrelated task for 10 min (i.e., handedness measure). For recognition, instructions were adapted from a previous study.^[31] More specifically,

²A group of unselected participants rated OC threat-relevant scenarios more negatively than positive [$t(87) = 60.57, P < .001$] and neutral [$t(87) = 26.74, P < .001$] scenarios. Moreover, positive scenarios were rated as more positive than neutral scenarios [$t(87) = 50.33, P < .001$]. For participants in the experiment, not all completed ratings (OC, $n = 18$; D/A, $n = 16$; NAC, $n = 17$) Ratings for these participants were submitted to a 3 (Group: OC, D/A, NAC) \times 3 (Scenario Type: negative, positive, neutral) ANOVA with repeated measurement. Results showed a main effect of Scene Type [$F(2, 96) = 1031.14, P < .001$] that revealed negative scenes were more negative than positive [$t(50) = 40.37, P < .001$] and neutral [$t(50) = 16.46, P < .001$] scenes. Additionally, positive scenes were rated as more positive than neutral scenes [$t(50) = 35.63, P < .001$]. There was no main effect of Group [$F(2, 48) = 1.53, P = .23$] or Scene \times Group interaction [$F(4, 96) = 1.94, P = .12$].

TABLE 1. Demographics and means (M) and standard deviations (SD)

	Groups		
	OC ($n = 28$) M (SD)	D/A ($n = 28$) M (SD)	NAC ($n = 29$) M (SD)
Females	27.6%	41.4%	31.0%
Age	18.7 (0.9)	18.6 (0.9)	19.2 (1.1)
Education	13.3 (1.2)	13.4 (1.0)	13.9 (1.0)
BDI	14.5 (10.1) ^a	14.8 (5.8) ^a	1.4 (1.1) ^b
STT	46.0 (9.6) ^a	49.4 (9.6) ^a	35.1 (7.8) ^b
STS	46.1 (11.2) ^a	45.9 (8.9) ^a	32.6 (8.2) ^b
OCI-washing	15.5 (2.9) ^a	0.9 (1.0) ^b	1.0 (1.2) ^b

BDI, Beck Depression Inventory; STS, Spielberger, State-Trait Anxiety Inventory, State Version; STT, Spielberger, State-Trait Anxiety Inventory, Trait Version; OCI, Obsessive Compulsive Inventory.

^aSignificantly different than nonanxious controls ($P < .05$).

^bSignificantly different than OC group ($P < .05$).

participants were asked to discriminate between “old” (i.e., previously presented) and “new” (i.e., not encoded yet thematically related to presented scenarios) words. For “old” words, participants made “remember” or “know” responses. Veridical recognition was the identification of an old word as old, whereas false recognition was the identification of a new, yet thematically related word, as old.

RESULTS

Mean “remember” and “know” responses were calculated for each scenario type and group; probabilities were based on the total amount rather than the total amount of items recognized. This allowed for remember and know responses to be independently modulated. See Table 2 for results.

Analysis was based on the methods adapted by another study^[31] and similar to other studies,^[44,45] separate analyses were performed for “remember” and “know.” Omnibus analyses were a 3 (Group: OC, D/A, NAC) \times 3 (Word Type: Threat, Positive, Neutral) ANOVA with repeated measurement. All main effects were submitted to a one-way ANOVA and Bonferroni corrected tests at α level .05 were used to further explore differences in group or word type.

TOTAL VERIDICAL RECOGNITION

A main effect of Word Type [$F(2, 164) = 14.74, P < .001$] but not Group [$F(2, 82) = 2.78, P = .07$] was shown; there was no Word Type \times Group interaction [$F(4, 164) = .05, P = .99$]. All participants remembered more threat than positive words [$t(84) = 5.0, P < .001$] and neutral words [$t(84) = 4.64, P < .001$]. However, recognition rate for positive words and neutral words was similar [$t(84) = .74, P = .46$].

“Remember” veridical recognition. We found main effects of Word Type [$F(2, 164) = 11.91, P < .001$] and Group [$F(2, 82) = 3.06, P < .05$]. However, there was no Word

TABLE 2. Mean recognition rates and standard deviations for obsessive compulsive threat, positive, and neutral words

Type of group	Veridical recognition		
	OC <i>M (SD)</i>	D/A <i>M (SD)</i>	NAC <i>M (SD)</i>
Threat total	0.74 (.17)	0.77 (.12)	0.70 (.16)
Remember	0.46 (.22)	0.60 (.18)	0.53 (.18)
Know	0.28 (.22)	0.17 (.17)	0.17 (.13)
Positive total	0.61 (.20)	0.62 (.21)	0.58 (.21)
Remember	0.37 (.21)	0.46 (.23)	0.42 (.21)
Know	0.24 (.18)	0.16 (.13)	0.16 (.14)
Neutral total	0.62 (.20)	0.66 (.18)	0.59 (.20)
Remember	0.40 (.24)	0.49 (.20)	0.46 (.24)
Know	0.22 (.21)	0.17 (.15)	0.13 (.16)
Type of group	False memories		
	OC <i>M (SD)</i>	D/A <i>M (SD)</i>	NAC <i>M (SD)</i>
Threat total	0.45 (.17)	0.44 (.15)	0.34 (.17)
Remember	0.22 (.15)	0.31 (.18)	0.23 (.16)
Know	0.23 (.16)	0.13 (.14)	0.11 (.12)
Positive total	0.43 (.18)	0.41 (.21)	0.36 (.18)
Remember	0.24 (.16)	0.26 (.20)	0.22 (.14)
Know	0.19 (.16)	0.15 (.14)	0.14 (.13)
Neutral total	0.22 (.15)	0.19 (.11)	0.16 (.11)
Remember	0.12 (.13)	0.11 (.10)	0.09 (.11)
Know	0.10 (.11)	0.08 (.08)	0.07 (.09)

Type × Group interaction [$F(4, 164) = 0.23, P = 92$]. For Group main effect, post hoc analysis revealed the D/A group used “remember” more than the OC group ($p < 05$). The NAC group did not differ from the OC ($P = 53$) or D/A group ($P = 79$). Participants used “remember” more for threat than positive words [$t(84) = 4.69, P < 001$] and neutral words [$t(84) = 3.72, P < 001$]. “Remember” for positive and neutral words was similar [$t(84) = 1.40, P = 17$].

“Know” veridical recognition. There was a main effect of Group [$F(2, 82) = 3.63, P < 04$] but not Word Type [$F(2, 164) = 2.04, P = 13$] and there was no Group × Word Type interaction [$F(4, 164) = 47, P = 76$]. Post hoc analysis showed the OC group used “know” more than the NAC group ($P < 04$) but not the D/A group ($P = 14$). There was no difference between the D/A and NAC groups ($P = 87$).

TOTAL FALSE MEMORIES

We found main effects of Word Type [$F(2, 164) = 67.68, P < 001$] and Group [$F(2, 82) = 3.86, P < 03$] but there was no Word Type × Group interaction [$F(4, 164) = 57, P = 69$]. Post hoc analysis showed the OC group had more memory errors than the NAC group ($P < 03$) but not the D/A group ($P = 85$). There was no difference between the D/A and NAC groups ($P = 12$). For Word Type all participants had more false memories for threat than

neutral words [$t(84) = 10.57; P < 001$] but not positive words [$t(84) = 46; P = 65$]. False memory was also greater for positive than neutral words [$t(84) = 10.23; P < 001$].

“Remember” false memories. There was a main effect of Word Type [$F(2, 164) = 37.79, P < 001$] but not Group [$F(2, 82) = 1.59, P = 21$]; there was no Group × Word Type interaction [$F(4, 164) = 1.29, P = 28$]. For Word Type all participants used “remember” more for threat than neutral words [$t(84) = 8.13; P < 001$] and more for positive than neutral words [$t(84) = 7.50, P < 001$]. There was no difference between threat and positive words [$t(84) = 73, P = 47$].

“Know” false memories. A main effect of Word Type [$F(2, 164) = 16.82, P < 001$] was modified by a Group × Word Type ordinal interaction [$F(2, 82) = 3.74, P < 03$]. Main effect of Group was close to significant [$F(2, 82) = 3.01, P = 06$] and was further explored to reveal the OC group endorsed more “know” false memories, an effect that was approaching significance relative to the NAC group ($P = 06$) but not the D/A group ($P = 23$). There was no difference between the D/A and NAC groups ($P = 86$). However, breakdown of the significant Group × Word Type interaction further modified this result, showing the increase in “know” false memories in the OC group manifested in threat words only, with the OC group recognizing significantly more “know” false memories for threat relative to both the D/A ($P < 05$) and NAC ($P < 01$) groups. There was no difference between the D/A and NAC groups ($P = 81$). See Figure 1.

FAMILIARITY INDEX

Assuming familiarity and recollection are independent, it follows that some items may be both familiar and recollected.^[23] In accordance with standard remember/know instructions, participants were told “know” responses should be made only in the absence of recollection, which may have underestimated the

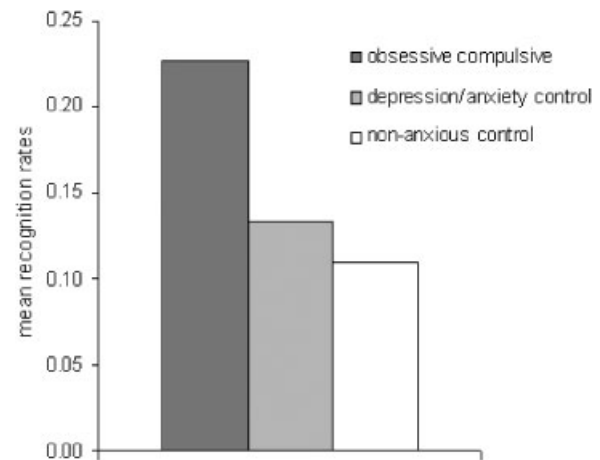


Figure 1. “Know” responses for falsely recognized threat words.

TABLE 3. Familiarity index for mean recognition rates and standard deviations for obsessive compulsive threat, positive, and neutral words

Type of group	Familiarity index		
	OC <i>M (SD)</i>	D/A <i>M (SD)</i>	NAC <i>M (SD)</i>
Threat			
Veridical recognition	0.50 (.30)	0.39 (.26)	0.36 (.26)
False memory	0.28 (.19)	0.18 (.17)	0.14 (.17)
Positive			
Veridical recognition	0.37 (.27)	0.33 (.32)	0.27 (.26)
False memory	0.24 (.19)	0.21 (.19)	0.18 (.17)
Neutral			
Veridical recognition	0.27 (.26)	0.24 (.26)	0.19 (.26)
False memory	0.11 (.13)	0.09 (.09)	0.08 (.09)

extent to which the OC group relied on “know” for threat recognition. Hence, we submitted a familiarity index:^[23] $F = K/(1-R)$ where “F” denotes false memory, “K” refers to “know” (i.e., feelings of familiarity) and “R” denotes “remember” to planned comparisons (i.e., two-tailed independent *t*-tests at .05 α level) to evaluate group differences for threat.

“*Familiarity Index*” for veridical recognition. The OC group had a greater familiarity index for threat words than the NAC group [$t(55) = 1.98$; $P < .05$] but not the D/A group [$t(54) = 1.49$; $P = .14$]. The D/A and NAC groups were similar [$t(55) = .53$; $P = .60$].

“*Familiarity Index*” for false recognition. The OC group had a greater familiarity index for threat words relative to the NAC group [$t(55) = 3.03$; $P < .004$] and the D/A group [$t(54) = 2.22$; $P < .03$], however, the NAC and D/A groups were similar [$t(55) = .84$; $P = .41$]. See Table 3.

DISCUSSION

We investigated false recognition and memory processes (“remember”, “know”) in individuals with OC washing symptoms (OC group). We hypothesized that the OC group relative to anxious (D/A) and nonanxious (NAC) control groups would exhibit more false memories for threat words and that “know” responses founded upon familiarity would be the primary memory process contributing to this effect. This hypothesis was partially supported. The OC group exhibited more false memories than the NAC group regardless of word type, yet, no difference between the OC and D/A groups emerged indicating individuals with depression and general anxiety may be vulnerable to making general memory errors. Deficits associated with depression^[46] may have contributed to this outcome. Consistent with our hypothesis, the OC group had significantly more “know” responses for

threat false memory items than either the NAC or D/A groups. These results suggest OC individuals may be susceptible to enhanced false memories for threat founded upon familiarity, and that this effect cannot be solely attributable to depression and general anxiety.

For “remember” responses, all groups showed enhanced false memories for threat and positive words relative to neutral words. This is in accordance with work demonstrating emotional material is more likely to be “remembered,” without necessarily enhancing memory accuracy.^[47]

For veridical recognition we made no predictions as verbal memory deficits in OCD have been inconsistent. Results showed all participants recognized more threat than positive words and neutral words with no difference between positive and neutral words. This is consistent with reports that negative information is recognized more accurately than positive or neutral information.^[48,49] Group main effects showed the D/A group used “remember” more than the OC, but not, the NAC group. In contrast, the OC group used “know” more than the NAC, but not, the D/A group. This finding, coupled with significantly increased “know” responses in the OC group for threat false memories relative to the other groups, and the familiarity index indicating the OC group falsely recognized threat more than the other groups, suggests memory differences in individuals with OC symptoms, particularly for threat, may manifest in terms of an over-reliance on familiarity, in the absence of a significant decrement in memories based on recollection.

Our results suggest a potential “know” response bias in OCD. Failure to obtain significantly enhanced “know” false memories for positive and neutral words in the OC group, nor significant reductions in false memories for threat, neutral, and positive scenarios in this group, indicates a simple global memory bias is unlikely. Nevertheless, enhanced veridical “know” memories in the OC group relative to the NAC, but not, D/A group, and reduced “remember” responses in the OC group relative to the D/A, but not, NAC group suggests the OC group may display memory impairments that manifest as a bias toward “know” responses.

This bias in veridical memory could result from the need for OCD individuals to be more certain before endorsing a memory. It is also possible that people with OC symptoms have a deficit in recollective ability or an over-reliance on familiarity. These explanations are in accordance with research that implicates verbal recollective impairments in OCD,^[50, 51] and a differential criteria for confidence in OCD.^[52] It should be noted, however, that these impairments have not been repeatedly observed, and hence further research needs to be done to reconcile these differences and elucidate the nature of OCD related impairments.

The finding that OC individuals relied on familiarity for threat-related false memory indicates there could be something specific about the nature of the material we

used. As stated in the introduction, semantic networks may be different for individuals with OC symptoms, relative to controls, for threat-related issues. That is, preoccupation with threat may lead to a well-elaborated network akin to having expertise for OC-relevant threat. Research suggests expertise results in more prolific and stronger connections, which increase the probability of supra-threshold activation of nodes, leading to greater false memory endorsement.^[53] Additionally, repeated checking itself can serve to decrease the clarity of memories.^[11–14] As the threat scenarios are highly familiar to individuals with OC symptoms, such that they performed compulsions, then, in accordance with evidence documenting checking can reduce recollective clarity, it follows that memories for threat-related scenarios were largely restricted to the “know” domain in OC individuals.

In summary, OC individuals appear to rely on feelings of familiarity, not detailed recollection, particularly when falsely recognizing threat-relevant words; the key finding being that individuals in the OC group were shown to have elevated false “know” memories for threat words relative to both the D/A and NAC groups as well as an enhanced familiarity index for falsely recognized threat words compared to both groups.

Our study has limitations. Results are based on an analogue OC sample; therefore, data may not generalize to clinical OCD. We did not include OC-irrelevant threat scenarios (e.g., sad words); hence, content-specificity of false memories between groups was not evaluated. Additionally, while affective ratings suggest threat-relevant words were of equal salience among groups, analysis was underpowered and words were not amenable to associative strength evaluation; therefore, we cannot rule out that potential saliency differences among groups may contribute to findings. Moreover, we used a traditional remember/know procedure,^[22] but others^[24] point out this procedure fails to account for false remember judgments. Therefore, it may be beneficial to examine false memories in OCD with models that provide a means to separately assess levels of both familiarity and recollection for stimuli. Lastly, OC participants may have used anti-anxiety medications, and such medications have been shown to reduce remembering and increase knowing^[54] thus possibly contributing to findings. Despite limitations, our results suggest feelings of familiarity for memory errors may play a role in OCD and further investigation of false memories in OCD may assist in the debate regarding memory deficits in OCD.

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