False memories in social anxiety disorder

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Abstract

Background: False memories are memories of events that never occurred or that occurred, but not exactly as we recall. Events with emotional content are subject to false memories production similar to neutral events. However, individual differences, such as the level of maladjustment and emotional instability characteristics of Social Anxiety Disorder (SAD), may interfere in the production of false memories. **Objectives:** This study aimed to assess the effect of emotion in memory performance for an event witnessed by participants with and without SAD. **Methods:** Participants were 61 young adults with SAD and 76 without any symptoms of SAD who were randomly assigned to watch a story with or without emotional arousal. Participants answered a subjective scale of emotion about the story and a recognition memory test. **Results:** Participants with SAD recovered more true memories and more false memories for the non-emotional version compared to the emotional version of the story. Overall, participants with SAD produced fewer false memories compared to those without SAD. **Discussion:** This finding suggests that social anxiety may have a significant impact on emotional memory accuracy, which may assist in the development and improvement of techniques for therapeutic intervention.

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Introduction

False memories, also referred to as distortions or illusions of memory, are memories of events that actually did not occur exactly as we remember[1]. This fact of recalling events that never occurred motivated several studies in the search for a greater understanding of these processes. It was observed that the level of emotional instability and mismatch significantly interferes in a greater number of false memories[2,3], which are present in anxiety disorders.

Among the anxiety disorders, Social Anxiety Disorder (SAD) stands out, consisting of a marked and persistent fear of social or performance situations in which the individual might feel ashamed, being afraid of taking action where he/she may be humiliated and embarrassed. The social exposure or performance provokes a response of anxiety interfering significantly in the individual's life[4,5]. It is estimated that the 12-month prevalence of SAD is 6.8% for the adult population[6], one of the most common psychiatric disorders with a lifetime prevalence of 12%[7].

It is known that in anxiogenic situations, perceptions of high probability of failure in performance are activated, which trigger cognitive, behavioral, and somatic symptoms causing a shift of attention from the environment to the individuals themselves, who remain in constant monitoring of their behavior, feelings, and physical sensations of anxiety[8]. This process is known as selective attention bias; anxious individuals initially direct their attention to a threat (e.g., emotional arousal with negative content), but then tend to shift attention in order to relieve sensations of anxiety, resulting in memory selectivity[9,10].

Moreover, individuals with SAD tend to doubt their memories, interpreting ambiguous memories of social events in a less positive (or more negative) way compared to those without SAD[11]. One of the reasons that may compromise reliability of an individual's memory is the belief that other people have a better memory[12]. One study found that less confident people (as in the case of individuals with SAD) accept the way the situation is recalled by another person (i.e., they acquiesce)[2], which can lead to increased vulnerability to mnemonic distortions[13].

SAD seems to be directly related to the fear of being rejected in social situations[14]. Individuals with a chronic level of maladjustment and emotional instability, notably insecure and inadequate, seem to be more easily swayed and susceptible to mnemonic distortions, such as false memories[15,16]. Recent studies have shown that individuals with psychosocial maladjustment produce more false memories[3]. Similarly, a desire for social interaction has been identified as a predictor of false memory for lists of semantically related words[17]. Despite these data, the literature still needs more research in clinical populations of individuals with anxiety disorders in general and with SAD, in particular.

Thus, the present study aims to investigate the performance of memory for events with and without emotional arousal, in a clinical sample of individuals with SAD. To do so, we used visual and audio material[18,19], as these conditions are highly more likely to stimulate emotional arousal in this population[8]. The main hypothesis to be tested presumes that individuals with SAD are more prone to false memories compared to healthy subjects. Furthermore, it is known that the levels of false memories seem to be influenced by the presence of emotion, which will be assessed systematically in this study[20,21].

Methods

Design

The present study involved a 2 x 2 x 3 x 3 full factorial, mixed design, with repeated measures for the final two variables. The first variable was clinical characteristic of the population, in which some participants presented SAD and others had no clinical characteristic of anxiety. The second between subjects variable was the emotional arousal of the story, in which half the participants were exposed to a story with emotional arousal and the other half to a story without emotional arousal. Participants with and without SAD were randomly

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assigned to watch either version of the story. Both versions of the story were divided into three phases (phase 2 is where the versions of the story differed in terms of arousal) and into three types on the memory test (target, related distractor, and unrelated distractor). The dependent variables were the assessment target of the emotionality of the story (i.e., arousal), which was measured from the subjective scale of emotion, and memory performance for the story's information in a recognition test.

Participants

Participants were 164 college students from Ribeirão Preto, São Paulo, Brazil who were diagnosed as part of a larger study on the prevalence of SAD[22]. All 2,319 students were contacted and invited to complete memory portion of the study.

Inclusion criteria for SAD sample were obtaining scores greater than or equal to 19 points in the Social Phobia Inventory (SPIN)[22,23] and scores greater than or equal to 20 points in the Beck Anxiety Inventory (BAI)[24], which indicate the presence of symptoms compatible with the diagnosis of SAD. The probable SAD individuals were evaluated by means of a version of the anxiety module of the Structured Clinical Interview for DSM-IV – Clinical Version (SCID-CV) translated and adapted to Portuguese[25], for diagnostic confirmation. Furthermore, additional inclusion criteria for both SAD and non-SAD samples included no significant symptoms of depression based on scores of 6 or less and 10 or less in the Patient Health Questionnaire (PHQ-9)[26] and the Beck Depression Inventory (BDI)[24], respectively; good quality of life and well-being based on scores equal to or lower than 7 points on the Self-Reported Questionnaire (SRQ-20)[27].

The final sample included 137 participants, 61 participants with SAD and 76 participants without symptoms of SAD. Among the participants with SAD, 98% did not use medication, 12% were in psychotherapy, no participant received a diagnosis of social phobia, 8% had a history of psychiatric disorder, and 18%, a history of psychiatric disorder in the family. Among the participants without SAD, 20% reported they had had some psychiatric symptom, however no one presented social phobia or was on medication, and 22% had a family history of psychiatric disorder. In addition, 6% of participants with SAD and 4% without SAD indicated that they were smokers or used drugs.

Participants were aged 17-34 years (M = 22.33; SD = 3.78), and 64% were female. Among the participants with SAD, 34 watched the emotional side of the story (mean age = 22.53, SD = 3.69), being 65% female. The number of participants with SAD who watched the non-emotional side of the story was 27 (mean age = 21.70, SD = 3.97), being 67% female. Among the participants without SAD, 44 watched the emotional version of the story (mean age = 23.32, SD = 4.12), and 64% were female. The number of participants without SAD who watched the non-emotional version was 32 (mean age = 21.28, SD = 2.92), being 59% female.

Instruments

The memory of the participants was assessed through a slideshow procedure[19], which was translated and adapted to Brazilian reality and to the investigation of false memories[18], with methodological improvements[28] for the memory test. The story consisted of 11 slides followed by a narrative divided into three phases. In phase 1 (slides 1-4), a mother and her son are on the way to the hospital where the father works; in phase 2 (slides 5-8), boy suffers an accident and goes to the hospital (arousal version) or the boy sees a crashed car and hospital procedures (non-arousal version); in phase 3 (slides 9-11), the mother goes away and calls home. Both versions had negative emotional content controlled for experimental purposes.

The emotional arousal of the story was assessed by a subjective 5-point Likert scale, ranging from "not emotional at all" (0) to "extremely emotional" (4).

Memory was tested by a self-administered memory recognition test composed of 84 yes-no items[28]. Participants were instructed to mark "yes" whenever the phrase corresponded to what was presented in the target material and "no" to all options that were not seen in the target material, even if it were information that could not be inferred about the event. The items of the test belonged to three categories: (i) target (equivalent to the measure of true memories); (ii) related distractor (equivalent to the measure of false memories); and (iii) unrelated distractor (equivalent to unrelated answers from error or "guess"). The items were distributed proportionally in relation to the three phases of the original material.

Procedure

The study was approved by the Research Ethics Committee on Human Rights of the College of Philosophy, Sciences, and Letters of Ribeirão Preto – São Paulo University (USP) (N. CEP-FFCLRP nº 534/2010). All participants signed an informed consent form, prepared according to the ethical guidelines for research with human beings.

The memory material was presented with the use of multimedia equipment, and data collection was performed in groups in a silent room. Participants were advised to pay attention to the story, and to avoid comments throughout the procedure. Immediately after, subjects answered the subjective scale of emotion. Participants were instructed to be as honest as possible and to select the option that represents what they have really felt in terms of the arousal attributed to the emotion stimulated by the story. Before answering the memory recognition test, participants participated in a buffer activity. The buffer activity aimed to prevent the participant from retaining the online information.

Data were analyzed using SPSS Statistics, version 20. To analyze the data obtained from these instruments, we used Analysis of Variance (ANOVA) with Bonferroni correction for post hoc analysis. All statistical treatments used a $\alpha < 0.05$ for hypothesis testing.

Results and discussion

An univariate ANOVA was conducted to test differences of emotional arousal between the versions of the story and presence of SAD. Results indicated a main effect of the version [$F(1.133) = 36.31$, $p < 0.001$], demonstrating that the emotional version stimulates more arousal (M = 1.81; SD = 1.14) than the non-emotional version (M = 0.80, SD = 0.72), which is consistent with previous studies[18,28,29]. In addition, we observed an effect of the presence of SAD [$F(1.133) = 5.52$, $p < 0.05$], which was responsible for a more intense evaluation of the effect of the stories' emotional arousal (M = 1.58, SD = 1.06) in comparison to the participants without SAD (M = 1.22, SD = 1.11), which is consistent with typical aspects of this disorder, in which individuals often become hypervigilant regarding their physiological alterations and their bodily sensations, which seems to interfere in how participants with SAD rated the material[30].

One hypothesis for this finding is that individuals with SAD believe that their appearance will accurately reflect all their physiological reactions of anxiety, which can be subject to scrutiny[11], causing these individuals to utilize a protective measure, ignoring the physiological reactions experienced or by camouflaging them. Furthermore, one presumes that individuals with SAD get used to living with anxiety, so they somehow adapt to the physical reactions caused in situations that generate anxiety. As a result, subjects with SAD may have had difficulty in recognizing the emotions generated by the narrative.

Overall effects of memory performance were analyzed by means of an ANOVA with repeated measures for the presence of SAD and the version of the story for each item type. The rates of non-mnemonic responses (or guesses) were very low and there was no difference between the groups (ps > 0.001), suggesting that participants were paying attention to the task.

Regarding true memory, results showed higher rates for participants who watched the non-emotional version (M = 0.75, SD = 0.10) when compared to those who watched the emotional version of the story (M = 0.70, SD = 0.13) [F(1.133) = 6.10, p < 0,05]. Result were qualified by an interaction trend between presence of SAD and version of the story [F(1,133) = 2.97, p = 0,09]. Participants with SAD recovered more true memories for the non-emotional version (M = 0.76, SD = 0.09) than for the emotional version of the story (M = 0.68, SD = 0.13, p < 0,05). Given the typical processing of people with high levels of anxiety, it is possible to hypothesize that anticipatory anxiety prevailed over attentional processes[30], causing individuals with SAD to remain more vigilant about the information of the video. This may have led to the lower rate of true memories for the emotional version.

With respect to false memories, there was a trend towards interaction between the presence of SAD and version of the story [F(1.133) = 3.76, p = 0.06], demonstrating increased production of false memories between the participants with SAD who watched the non-emotional version (M = 0.39, SD = 0.13) in comparison to those who watched the emotional version of the story (M = 0.31, SD = 0.15; p < 0.05). Among the participants who watched the non-emotional version, there was a trend toward greater production of false memories in participants with SAD in comparison to those without SAD (M = 0.32, SD = 0.12; p = 0.08).

These results suggest that memory from participants with SAD is affected by emotional nature of the story, which, in addition to their poor social skills (responsible for high levels of maladjustment and emotional instability) and attentional biases, made them vulnerable to selective memory performance. Overall, individuals with SAD exhibit impaired activation in the associative, interpretative, and attentional processes potentially leading to an attentional bias[31,32], especially for stimuli perceived as dangerous or threatening[33,34].

Anxiety disorders result in distortions in information processing, leading to perceptual sensitivity and memory bias[34-36]. This result seems to be in line with the findings of the study that proposes that individuals with SAD accept more outside influences when the situation is devoid of arousal, believing that the source of the material is more reliable than their own memory, and they reject more information of the memory test in general (both true and false)[2].

An analysis of the results between the phases of the story was performed to isolate the effect of the arousal in the second phase of the story when arousal information was presented only in the emotional version. An ANOVA with repeated measures was performed for the presence of SAD and version of the story for each type of item (Table 1).

There was a main effect of phase for true memory [F(2.132) = 91.53, p < 0.001], indicating an increase in true memories in phase 2 in comparison to phase 3 (p < 0.001). This result was qualified by an interaction trend between the presence of SAD, version of the story, and phase [F(2.132) = 2.47, p = 0.09], in which we observed an increase in true memory in phase 2 compared to phase 3 under all conditions (p < 0.05 for all cases). The effect of emotion from phase 2 was also observed in an interaction with presence of SAD, given that participants without SAD recovered more accurate information than participants with SAD (p < 0.05). Among participants with SAD, there was an increase in true memories for phase 2 for the non-emotional version of the story compared to the emotional version (p < 0.05).

With respect to false memories, there was a main effect of phase [F(2,132) = 116,17, p < 0.001]. The results showed that fewer false memories are produced in phase 2 than in phases 1 and 3 (ps < 0.001) and in phase 1 than in phase 3 (p < 0.05). In contrast, we observed an effect of phase on the production of non-mnemonic responses [F(2.132) = 3.69, p < 0.05], with lower indices for phase 2 than phase 1, although all indices were low in general. In this sense, the vulnerability of memory does not seem to be associated with emotional arousal for individuals with SAD. Therefore, the emotional arousal seems to be protective of memory in subjects with SAD, in line with the idea that anxious people effectively recall information related to risk[34].

Finally, we can conclude that individuals with SAD present mnemonic changes. The results of this study help to further understand the attentional and mnemonic processes in individuals with SAD, and may assist in the development and improvement of techniques for therapeutic intervention. However, longitudinal studies, assessing memory performance before and after different treatment modalities (CBT, pharmacotherapy) and studies comparing SAD individuals to individuals with other anxiety disorders are deemed necessary and appropriate.

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Table 1. Mean of recognition (and standard deviation) by version of the story, type of item, and phase for participants with and without social anxiety disorder

		Version of the story				
Phase	Item Type	Emotional		Non-emotional		Total
		With SAD	Without SAD	With SAD	Without SAD	
1	TM	0.72 (0.16)	0.78 (0.12)	0.83 (0.11)	0.77 (0.14)	0.77 (0.14)
	FM	0.33 (0.15)	0.37 (0.18)	0.43 (0.16)	0.36 (0.15)	0.37 (0.16)
	UA	0.05 (0.12)	0.02 (0.06)	0.05 (0.16)	0.03 (0.08)	0.03 (0.11)
2	TM	0.70 (0.16)	0.77 (0.16)	0.82 (0.12)	0.80 (0.13)	0.77 (0.15)
	FM	0.19 (0.15)	0.21 (0.13)	0.24 (0.13)	0.21 (0.16)	0.21 (0.14)
	UA	0.01 (0.06)	0.01 (0.05)	0.00 (0.00)	0.01 (0.04)	0.01 (0.05)
3	TM	0.62 (0.17)	0.61 (0.16)	0.65 (0.12)	0.64 (0.14)	0.63 (0.15)
	FM	0.42 (0.22)	0.44 (0.23)	0.50 (0.20)	0.41 (0.21)	0.44 (0.22)
	UA	0.01 (0.04)	0.01 (0.04)	0.05 (0.12)	0.02 (0.07)	0.02 (0.07)

SAD: social anxiety disorder; TM: true memory; FM: false memories; UA: unrelated answers.

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