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Negative autobiographical memories in social anxiety disorder: A comparison with panic disorder and healthy controls

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Abstract

Background and objectives: Empirical interest in mental imagery in social anxiety disorder (SAD) has grown over the past years but still little is known about the specificity to SAD. The present study therefore examines negative autobiographical memories in participants with social anxiety disorder (SAD), compared to patients with panic disorder (PD), and healthy controls (HCs).

Methods: A total of 107 participants retrieved four memories cued by verbal phrases associated with either social anxiety (SA) or panic anxiety (PA), with two memories for each cue category.

Results: PA-cued memories were experienced with stronger imagery, and as more traumatic. They were also rated as more central to identity than SA-cued memories, but not among participants with SAD, who perceived SA-cued memories as equally central to their identity. When between-group effects were detected, participants with anxiety disorders differed from HCs, but not from each other.

Limitations: Central limitations include reliance on self-report measures, comorbidity in the anxiety disorder groups, and lack of a neutrally cued memory comparison.

Conclusions: The findings align with models of SAD suggesting that past negative social events play a central role in this disorder. Future research is suggested to further explore the function of negative memories, not only in SAD, but also in other anxiety disorders.

1. Introduction

Empirical interest in mental imagery in social anxiety disorder (SAD) has grown over the past years, and studies have shown that individuals high in self-reported social anxiety experience negative imagery more so than individuals low in self-reported social anxiety (Hackmann, Suraway, & Clark, 1998). In addition, studies have indicated that negative self-imagery has a causal role in maintaining SAD by increasing state anxiety, enhancing negative self-judgments, and having a detrimental effect on performance (Hirsch, Clark, Mathews, & Williams, 2003; Hirsch & Holmes, 2007). Correspondingly, recent intervention approaches have been targeting past negative social events and related imagery with promising results (Frets, Kevenaar, Heiden, 2014; Wild, Hackmann, & Clark, 2007).

1.1 Autobiographical memories and related imagery in SAD

Individuals high in self-reported social anxiety and individuals with SAD differ from from individuals low in self-reported social anxiety and healthy controls (HCs) on a number of phenomenological characteristics of their memory imagery (for a review, see Morgan, 2010). Socially anxious individuals may experience mental images related to autobiographical memories as more negative (Hinrichsen & Clark, 2003), vivid, detailed in quality (Wild et al., 2007), and to a larger extent view them from an observer's perspective (Coles, Turk, Heimberg, & Fresco, 2001; D'Argembeau et al., 2006; Hinrichsen & Clark, 2003; Wells & Papageorgiou, 1999; Wells, Clark, & Ahmad, 1998).

Imagery in SAD may be linked in time with negative, self-defining autobiographical memories (Hackmann, Clark, McManus, 2000; Morgan, 2010; Moscovitch, Gavric, Merrifield, Bielak, & Moscovitch, 2011), a notion that was first introduced by Singer and Salovey (1993). In general, autobiographical memories differ in the degree to which they are perceived as central to the person's identity or life story (Berntsen & Rubin, 2006, 2007). To perceive some, but not all, memories as central has been argued to help give meaning and structure to our life narratives, providing anchors for and stabilizing conceptions of ourselves (e.g., Baerger & McAdams, 1999; Pillemer, 1998, 2003; Robinson, 1992; Robinson & Taylor, 1998; Shum, 1998). However, these anchors may become fixed reference points and bring about rigidity in negative self-assumptions in case a highly negative event takes this role (Berntsen & Rubin, 2006; Berntsen, Willert, & Rubin, 2003). For instance, an individual with SAD who has experienced humiliation when speaking in front of others may avoid public speaking in order to prevent similar, future failures.

Autobiographical memories can be retrieved either voluntarily, that is by a deliberate effort to recall an episodic event, or involuntarily, referring to spontaneously occurring retrieval that takes place with no preceding retrieval attemtpts, typically when situational cues map onto episodic events from the past (Berntsen, 1996, 2009). Individuals with SAD may ruminate about past social events (Clark & McManus,

2002), thereby engaging in voluntary retrieval of anxious memories. Regarding involuntary retrieval, individuals with SAD have been found to experience spontaneously occurring retrieval of past events in anxiety provoking situations (Hackmann et al., 1998; Hackmann et al., 2000). Such spontaneously occurring recall of negative events may be experienced as having an intrusive character, a notion that is supported by a study showing that socially anxious individuals experience having poor control over their images (Moscovitch, Chiupka, & Gavric, 2013). In fact, individuals with SAD have been shown to react to socially stressful memories with PTSD-symptoms (Erwin, Heimberg, Marx, & Franklin, 2006).

Finally, retrieved events differ in specificity, that is, the degree to which the memories concern a specific episodic event. Non-specific, overgeneral memories are a common phenomenon in major depressive disorder (e.g., Watson, Berntsen, Kuyken, & Watkins, 2012; Williams et al., 2007) and prevalent in PTSD (e.g., McNally, Lasko, Macklin, and Pitman, 1995; Moore & Zoellner, 2007), but likely not so in other anxiety disorders (Wessel, Meeren, Peeters, Arntz, & Merckelbach, 2001) including SAD (Heidenreich, Junghanns-Royack, & Stangier, 2007).

1.2 Disorder and content specificity in SAD

Most research to date on autobiographical memories and imagery in SAD has not included an anxiety control group, which calls the specificity of the findings into question. First, specificity may concern *disorder* specificity, understood as the extent to which there are SAD-specific characteristics that apply across types of retrieved memories. Second, the cognitive specificity hypothesis (Beck, 1987; Clark & Beck, 2010) concerns disorder specific biases and addresses what may be termed *content* specificity. This concerns the question of whether imagery in SAD is different for events characterized by *social anxiety* compared with content non-specific to social anxiety.

These two types of specificity have been sparsely studied comparing SAD and other anxiety disorders. Wells and Papegeorgiou (1999) found that only individuals with SAD, not individuals with blood/injury phobia, agoraphobia, or HCs, shifted their recall perspective depending on the content of the recalled situation. They recalled social situations from an observer perspective and neutral situations from a field perspective. Harvey, Ehlers, and Clark (2005) found that in the recall of social situations, individuals with SAD and PTSD did not differ from each other, but differed from HCs, in their rating of the extent to which they looked embarrassed in the event. However, individuals with SAD claimed that the events had a higher impact on their future than individuals with PTSD. Wenzel and Cochran (2006) investigated retrieval of autobiographical memories prompted by automatic thoughts prototypical of SAD or panic disorder (PD) or neutral sentences in individuals with SAD, PD and HCs. Only one difference emerged between the anxiety groups, where individuals with PD were faster at generating memories when prompted by PD-related

thoughts than both individuals with SAD and HCs. This pattern was not found for SAD and SAD-related thoughts. Finally, a study by Witheridge, Cabral, and Rector (2010) investigated cued autobiographical memory content in individuals with SAD, PD, and major depressive disorder. The SAD group did not report more social evaluation memory content than the depressed or PD group and no overall between-group differences in cognitive vulnerability characteristics were observed. Taken together, the studies have revealed mixed findings, and our knowledge about which characteristics of autobiographical memory recall are specific to the type of memory and/or to SAD is generally an under-investigated area. This is unfortunate as it would seem crucial to understand which characteristics of the imagery are disorder and/or content specific in order to appropriately and effectively target current and new treatments.

1.3 Aims and hypotheses

The present study is an examination of autobiographical memories of negative events and related imagery in SAD, PD and HCs, investigating two types of autobiographical memories across groups; one cued by social anxiety (SA)-related words and one by panic anxiety (PA)-related words. Individuals with PD were chosen as a comparison group for three reasons: 1) The two diagnoses are comparable in that they are associated with anxiety in a variety of situations. However, 2) the focal points of anxiety differ between the disorders in that individuals with SAD mainly fear the negative evaluation of others and individuals with PD mainly fear the occurrence of internal anxious sensations. Finally, 3) individuals with SAD have most often been compared with individuals with PD.

Regarding content specificity, we expected SAD participants' memories cued by SA-related phrases to be experienced as more negative and vivid, and viewed from an observer's perspective, when compared with their memories cued by PA-related phrases. Concerning disorder specificity, we hypothesized that, compared with HCs, participants with SAD would report more voluntary and involuntary recall of anxious events, and perceive the events as having a greater traumatic impact and playing a more central role in relation to their identity. Given the sparse research comparing SAD to other anxiety disorders, we did not formulate any a priori hypotheses regarding differences between the anxiety disorders, and analyses concerning this issue are exploratory.

2. Methods

2.1 Participants and procedures

Participants with SAD and PD were recruited from an outpatient anxiety clinic at Aarhus University Hospital, Denmark. Anxiety disorders were diagnosed according to DSM-IV criteria with the Anxiety Disorders Interview Scale for DSM-IV (ADIS-IV; Brown, DiNardo, & Barlow, 1994). All diagnostic interviews

were conducted by a team of clinicians, who met on a weekly basis to peer supervise diagnoses. Inclusion criteria were a primary diagnosis of SAD or PD, age ≥ 18 years, and Danish language proficiency. Exclusion criteria were a severe mental illness, including bipolar disorders, psychotic disorders, and severe depression.

All patients fulfilling the inclusion criteria (SAD: N=103, PD: N=27) were e-mailed a link to an online survey prior to the beginning of treatment. Seventy-eight (60%) individuals responded; 58 with SAD and 20 with PD. There was no difference between responders and non-responders on age, t(128) = 1.6, p = .114, or gender, X^2(1) < .1, p = .941, but there was a tendency for more individuals with SAD to respond, X^2(1) = 3.1, p = .076. Of the participants with SAD, 25 had no comorbid disorders, nine had comorbid, secondary anxiety disorder, 14 had comorbid depressive disorder, and 10 had both comorbid secondary anxiety and depressive disorders. Of the participants with PD, 12 had no comorbid disorders, 3 had comorbid secondary anxiety disorder, 3 had comorbid depressive disorder, and 2 had both comorbid secondary anxiety and depressive disorders.

Fifty healthy controls (HCs), matched on gender and age to the clinical participants, were recruited from a pool of volunteer college students. With HCs being college students, it was not possible to match for education. Six individuals did not respond, three individuals did not want to participate, and five individuals were excluded before the diagnostic interview due to a psychiatric diagnosis. The remaining 36 students were screened for psychiatric disorders with the same instruments as the anxiety groups. Diagnostic assessments were provided by the first author, who had received formal clinical training in diagnostic assessment. Inclusion criteria were Danish language proficiency and age ≥ 18 years. Individuals were excluded if they had any current or prior psychiatric disorder, except for a major depressive disorder of mild or moderate severity that ended more than 6 months prior to inclusion. Following the diagnostic interviews, 3 individuals were excluded due to past or psychiatric disorders (per exclusion criteria), leaving 33 individuals, of whom three had experienced one past depressive episode of mild severity. Twenty-nine individuals completed the online questionnaires.

The study was conducted in accordance with national ethical committee guidelines, and all participants received written information about the study and consented to participation.

2.2 Design

We employed a 3 x 2 mixed factorial design in this study. The between subjects factor was labelled group and had three levels, corresponding to the three participant groups assessed (PD, SAD & HC) and the repeated measures factor had two levels, corresponding to the two types of memories reported (PA-related & SA-related).

2.3 Materials

Measures of psychopathology

Depressive symptoms were assessed by The Beck Depression Inventory-2nd version (BDI-II), which is a 21-item self-report questionnaire rated on a 4-point scale (Beck, Steer, Ball, & Ranieri, 1996). In this study, the scale obtained a Cronbach's α of .95.

Anxiety symptoms were measured using The Beck Anxiety Inventory (BAI), which is a 21-item self-report instrument (Beck, Epstein, Brown, & Steer, 1988). Items were rated on a 4-point scale and obtained a Cronbach's α of .96 in this study.

Measures of negative memories

Participants recalled four negative memories of specific, past events; two cued by SA-related words, and two cues by PA-related words. "Specific" was defined as an event that took place within a 24-hour period and examples were given. The following instructions were given: "We would like you to think of one of or the most anxiety-provoking memory that you can recall that was characterized by one or more of these emotions [verbal, emotional prompts]". Prompts were "embarrassment", "humiliation", "mortification", and "shame" for the SA-cued memories, and "loss of control", "panic", "fear of dying", and "fear of going crazy" for PA-cued memories. The cues were chosen based on prototypical emotional descriptors of the two disorders (e.g. American Psychiatric Association, 2013; Clark & Beck, 2010) and presented in a counterbalanced order.

Past overall emotional intensity was assessed with the question "how emotionally intense was the situation?" and rated on a 7-point scale from 1 to 7, with 7 referring to "extremely intense" and 1 "not at all intense. For each memory the participant rated the extent to which it involved SA-emotions (embarrassment, humiliation, shame, mortification) and PA-emotions (loss of control, panic, fear of going crazy, and fear of dying). The emotions were rated on a 5-point scale, leaving two indexes of *emotion-specific intensity* for each memory.

Autobiographical memory properties were assessed with 14 questions regarding the participants' experience when being asked to deliberately recall the event. Furthermore, participants were asked about voluntary and involuntary recall of the event in their everyday lives. The items were modified from Rubin, Schrauf, and Greenberg (2003) and Berntsen and Rubin (2006), and were all rated on a 7-point scale. See Table 1.

Centrality of event was measured for each of the four memories using the Centrality of Event Scale (CES; Berntsen & Rubin, 2006), which addresses how central an event is to a person's identity and life story. We used the short 7-item questionnaire. The internal consistency of the CES as measured by Cronbach's α was .94/.95/.93/.93, corresponding to each of the four rated memories in the present study. Participants

with anxiety disorders were also asked to rate the degree to which they believed that the anxious event had contributed to their current condition. All items were rated on a 5-point scale from 1 to 5.

Current traumatic impact was measured by the first 7 items of the PTSD self-report checklist (PCL; Weathers, Litz, Herman, Huska, & Keane, 1993) that could meaningfully be repeated for each of the memories. The items concerned reliving/intrusion (intrusive recollection, flashbacks, distressing dreams, and physical reactions to reminders of event) and avoidance (avoidance of thought and reminders) of the event. Items were modified to address the individual memories, were rated on a 5-point scale from 1 to 5, and obtained a Cronbach's α of .93/.91/.90/.90 in this study.

2.4 Coding procedures

All memories were coded for specificity and anxiety-related content based on the participants' descriptions. A memory was categorized as specific if it included an event that happened, or had most likely happened, within a 24-hour period (cf. Williams et al., 2007). Regarding content, coders made an overall judgment based on the *primacy* of either SA- or PA-content, and a memory was considered a congruent SA- or PA-memory, when there was a match between the memory content coded objectively and type of emotional prompts.

Codings were performed by the first author on a data sheet where the group variable was masked. A research assistant trained in identifying specificity and content, and blind to participant status, independently rated 25% of the memories (N = 105). The agreement between the two raters regarding specificity was good (Cohen's kappa = .81). Concerning content, 45 of the 416 memories were not possible to categorize as either a SA- or PA-congruent based on the participants' descriptions. When exploring differences in number of congruent (and incongruent) memories, these uncategorized memories were not included. The agreement between the two raters was good (Cohen's kappa = .86).

To supplement the content codings, we investigating the intensity of the two types of emotions in the two types of memories exploring 1) if there was an overall higher intensity of SA emotions in the SA-cued memories versus PA-cued memories, and vice versa for the PA-emotions, and 2) if there was a higher intensity of SA-emotions versus PA-emotions within SA-cued memories, and vice versa for the PA-cued memories.

The objective codings and emotion ratings were used to explore the association between the memory content and the emotions specified in the cues (i.e., PA- vs. SA-related cues).

2.5 Analytic strategy

Since two of the three groups were relatively small with an *N* below 30, the assumptions for parametric tests were explored. Based on visual inspection of the distribution of both raw scores and residuals of the dependent variables, we proceeded with parametric tests.

Measures of the same memory type (SA vs. PA) were averaged across the two individual memories reported by each participant, leaving one aggregate variable per memory type. Main analyses consisted of Mixed 2 x 3 ANOVAs with Memory type (SA vs. PA) and Group (SAD vs. PD vs. HC). Because the *N*s of the three groups differed, post-hoc comparisons were based on Gabriel's procedure (cf. Field, 2013). Main analyses were based on the subjective (cued) not the objective (coded) content.

Effect sizes for the ANOVAs were expressed in partial eta square (η_p^2) and a value of .02, .13, and .26 was considered a small, medium, and large effect, respectively (Cohen, 1988). Significant interaction terms were explored with dependent samples *t*-tests. All analyses were performed in IBM SPSS version 21.

3. Results

3.1 Participant and memory descriptives

In total, 107 individuals participated in the study. See Table 2 for participant descriptives. There was no difference between the 3 groups regarding age, $F(2, 106)=2.3$, *p*=.102, or gender $X^2(2)=4.4$, *p*=.110. However, there was a between-group difference on both the BDI-II, $F(2, 105)=37.5$, *p*<.001, and the BAI, $F(2, 106)=409$, *p*<.001, where post-hoc comparisons showed that the two clinical groups had a higher score than the HCs but did not differ from each other. Twelve participants were missing one of the two PA-memories or one of the two SA-memories. In these cases, the single memory served as a representative for the memory category in question and no mean was calculated. This left a total of 416 recorded memories.

3.2 Objective categorization of memories

There was a difference between groups in number of specific memories recorded, $F(2, 104)=5.0$, *p*=.008, η_p^2=.09. Post-hoc tests revealed that participants with SAD (M=3.0, SD=1.0) differed from HCs (M=3.7, SD=.7), *p*=.005, but did not differ from participants with PD (M=3.2, SD=.9), *p*=.819, and PDs and HCs did not differ from each other, *p*=.201. When all groups were combined, the level of depressive symptoms (BDI-II) were negatively correlated with the number of specific events (*N*=106, *r*=-.21, *p*=.032). However, the level of depressive symptoms did not correlate with number of specific events recorded for either participants with SAD (*N*=57, *r*=-.04, *p*=.744), PD (*N*=20, *r*=-.08, *p*=.737), or HCs (*N*=29, *r*=.10, *p*=.582).

A 2 cue type (SA- vs. PA related cues) x 3 Group (HC vs. SAD vs. PD) analysis was conducted. There was no main effect of cue type for the number of cue congruent memories recalled across the two cue

categories, $F(1, 66)$=.6, p=.441, η_p^2=.01. There was a significant between-group difference, $F(2, 66)$=7.7, p=.001, η_p^2=.19. Post-hoc analyses revealed that both the HCs (p=.001) and individuals with SAD (p=.046) retrieved more cue-congruent memories than individuals with PD, whereas there was no significant difference between HCs and individuals with SAD (p=.082). See Table 3. A significant interaction was also identified, $F(2, 66)$=9.1, p<.001, η_p^2=.22. While the difference in number of cue-congruent memories did not statistically differ within HCs, $t(19)$=1.9, p=.072, the SAD group retrieved more congruent memories for the SA-prompts than PA-prompts, $t(35)$=3.8, p=.001. The opposite was found for the PD group, $t(12)$=2.3, p=.035.

3.3 Disorder biased ratings of emotional intensity

A 2 cue type (SA vs. PA) x 2 self-reported emotion (SA vs. PA) x 3 Group (HC vs. SAD vs. PD) ANOVA revealed no overall intensity difference between SA versus PA cued memories, $F(1, 104)$<.1, p=.965, η_p^2<.01. A significant between-group effect emerged, $F(2, 104)$=26.1, p<.001, η_p^2=.33, showing that the two anxiety groups overall scored higher on emotion intensity than the HCs (ps<.001), but did not differ from each other (p=.252). The three-way interaction term was significant, $F(2, 104)$=5.2, p<.001, η_p^2=.19. See Figure 1. HCs reported higher intensity of SA emotions than PA-emotions *within* the SA-cued memories, (M_{diff}=1.5, SD=.6), $t(28)$=11.5, p<.001, and vice versa for the PA-cued memories, (M_{diff}=1.5, SD=.8), $t(28)$=2.8, p=.010. Participants with SAD also reported higher SA-emotion than PA-emotion intensity within the SA-cued memories, (M_{diff}=1.3, SD=.9), $t(28)$=8.9, p<.001, but did not differ on these emotions within the PA-cued memories, (M_{diff}=.6, SD=1.4), $t(57)$=-.4, p=.667. The opposite pattern was found for participants with PD who reported higher levels of PA-emotions than SA-emotions intensity within PA-cued memories, (M_{diff}=1.1, SD=1.4), $t(19)$ = 3.8, p=.001, but did not differ on these emotions within SA-cued memories, (M_{diff}=.6, SD=1.8), $t(57)$=.2, p=.826.

3.4 Differences between social anxiety and panic anxiety memories

Means and standard deviations for all measures rated by the participants can be found in Table 4. A main effect of memory concerns overall differences between PA- and SA-cued memories, whereas the interaction effects relate to the assumption of content specificity, namely whether characteristics of the SA-cued memories would be rated higher than characteristics of the PA-cued memories in the SAD group (and vice versa for the PA group). See Table 5 for within- and interaction effects from the ANOVAs.

Regarding autobiographical memory properties, PA-cued memories were overall rated higher than the SA-cued memories on *visual* imagery, the degree to which participants remembered the physical *surroundings*, the *vividness* of the memory, and *worry* that the event will happen again. Effect sizes were of

a small magnitude. Moreover, a small interaction effect was detected regarding the *olfactory* imagery associated with the memory. Participants with SAD, $t(56)=3.4$, $p=.001$, showed a difference between the two memories, with the highest ratings for the SA-cued memories, which was not the case for PDs, $t(19)=.7$, $p=.479$, nor HCs, $t(28)=1.0$, $p=.333$. There were no differences between the memories regarding voluntary and involuntary recall.

PA-cued memories obtained a higher score regarding centrality of event compared with SA-cued memories, corresponding to a medium effect. However, there was a small interaction effect. While both HCs, $t(28)=3.5$, $p=.002$, and PDs, $t(19)=2.8$, $p=.011$, rated PA-cued memories higher on centrality, the SAD group rated both memory types as equally central, $t(56)=.6$, $p=.549$. A post-hoc correlation between the centrality score of SA-cued memories and intensity of SA emotions was significant for SAD participants, $r=.42$, $p=.001$, but not for the two other groups (PD: $r=.34$, $p=.143$; HC: $r=.12$, $p=.529$).

When asked if the anxious memory contributed to the current condition, PA-cued memories were reported to contribute more to the clinical participants' current condition. Furthermore, PA-cued memories were rated as having a higher traumatic impact than SA-cued memories, and finally, PA-cued memories were rated as having happened later in life. These effects were of a small magnitude.

3.5 Differences between groups

Between-group effects concern the question of disorder specificity, that is, whether there are overall differences between the three groups. See Table 5 for between-group effects from the ANOVAs. Participants with anxiety disorders recalled the memories as being more intense. Concerning autobiographical memory properties, the two clinical groups differed from the HCs, but not each other, in that they reported: *reliving* the event to a higher degree; experiencing *visual*, *auditory* and *olfactory* imagery to a higher degree; experiencing the memory as more *vivid*; experiencing the *same feelings* and *bodily sensations* as in the original event; experiencing emotions at a higher *intensity*; experiencing an overall more negative *valence*; and *worried* more that the event would happen again. Effects were of a medium to large magnitude. The groups did not differ on the degree to which they experienced the event as coming to them in *words*, the *perspective* from which they recall the event, or the *belief* that the event happened as they recalled it. Regarding recall of the event in their everyday lives, the clinical groups reported more *involuntary* recall than the HCs. Participants with SAD were also more likely than HCs to engage in *voluntary* recall. This difference was not detected for participants with PD, but the two clinical groups did not differ significantly from each other. Participants with SAD and PD scored higher on *centrality* than HCs, but did not differ from each other. No differences between the two anxiety groups regarding the contribution of the memories to present condition emerged. Finally, a large between-group effect

emerged, where the two clinical groups reported the memories as having a greater traumatic impact on their current lives compared with the HCs.

4. Discussion

Participants were asked to rate four memories; two cued by SA-related words and two cued by PA-related words. Overall, the experimental paradigm was successful in that HCs generated SA memories when prompted with SA-relevant emotional prompts, and vice versa for PA-memories, as found in analyses based on objective categorization of the memories as well as participants' self-rating of emotions. However, this pattern did not characterize the two patient groups. First, participants with anxiety disorders had more cue-congruent memories when prompted with word phrases relevant to their specific disorder. Second, although the level of SA- and PA emotion reported in the memories overall varied in accordance with the cue phrases, so that PA-cued memories contained more intense PA-related emotion and vice versa for SA-cued memories, participants with SAD did not report a difference in SA- versus PA-emotional intensity within PA-cued memories (but did so for SA-cued memories), and participants with PD did not report a difference in emotional intensity in SA-cued memories (but did so for PA-cued memories). These findings align with the literature on recall bias in anxiety disorders (cf. Becker, Roth, Andrich, & Margraf, 1999; Clark & Beck, 2010; Coles & Heimberg, 2002; Morgan, 2010; Krans, de Bree, & Bryant, 2014), suggesting that individuals with anxiety disorders are likely to retrieve disorder-congruent (rather than cue-congruent) events.

Overall, participants rated PA-cued memories higher on a number of variables, including visual imagery, vividness, better recall of the physical surroundings, worry, centrality of event and traumatic impact. These findings are in accordance with a study showing that PA-cued memories are experienced as more vivid and induce stronger imagery than SA-cued memories (Wenzel, Pinna, Rubin, 2004). One reason for this could be that the PA cues across participants were more likely to elicit memories of traumatic events. Thus, recall of memories characterized by a relatively stronger presence of PA-emotions, regardless of diagnosis, may be overall more intrusive and associated with painful re-experience.

Concerning content specificity, participants with SAD was the only group not to report a difference in centrality of event between PA-cued and SA-cued memories, whereas the other two groups rated PA-cued memories as more central. Since participants with SAD reported higher levels of SA-emotions in SA-memories versus PA-memories, this finding indicates that the higher the intensity of SA-emotions, the more central the memory is to their identity. A post-hoc significant correlation between the centrality score and intensity of SA-emotions in the SAD group supported this notion. This finding aligns with models and

research of SAD, indicating that past negative social events come to play a marked and central role in the lives of individuals with SAD (Clark & Wells, 1995; Hackmann et al., 2000; Wild et al., 2007).

Regarding *disorder* specificity, participants with anxiety disorders differed from HCs, but did not differ from each other. Participants with anxiety disorders experienced stronger imagery, and experienced the memories more intensely, negatively, and vividly, with the same feelings and bodily sensations as in the original event. They also worried more that the event would happen again, and engaged in more voluntary and involuntary recall. Finally, participants with anxiety disorders experienced the events as more central to their identity and having a higher traumatic impact than HCs. Although individuals with SAD did not differ from individuals with PD, a diagnosis of SAD was, contrary to past findings (Heidenreich et al., 2007), associated with fewer specific memories than recorded by HCs. PA-cued memories, compared with SA-cued memories, have previously been found to involve more frequent recall of specific events (Wenzel et al., 2004), and one may thus speculate that the finding in part has to do with the content of the memories recorded by participants with SAD. Contrary to previous research (see Morgan, 2010 for a review), participants with SAD were not more likely to recall the anxious events in general, or the SA-cued memories specifically, from an observer's perspective.

Taken together, the findings point to both theoretical and clinical implications. The finding that disorder specific memories were rated as highly central to personal identity for both clinical groups, and the finding that individuals with anxiety disorders retrieved higher numbers of, and more emotionally intense, memories in response to disorder-relevant cues, is consistent with general models of autobiographical memory which suggest that the self-relevant goals or current concerns of the individual influence the frequency and nature of autobiographical memories retrieved (Conway & Pleydell-Pearce, 2000; Johannessen & Berntsen, 2010). Furthermore, models of both SAD and PD highlight that internal and external cues can trigger the activation of threat schemas (e.g., Beck, Emery, & Greenberg, 1988; Clark & Beck, 2010; Clark & Wells, 1995). One potential link between such cues and activation of schemas may be the recall of a negative autobiographical memory either brought about voluntarily or involuntarily. The individual may notice something in the environment (e.g., a threatening look) or an internal sensation (e.g., increased heartbeat) that bears similarities to a past negative event and informs elaborative reappraisals of the current situations (e.g., "It will be humiliating when he asks me something I cannot answer just like that time" or "I will have a panic attack just like then"). For individuals with SAD specifically, negative self-images rooted in previous negative experiences, have been suggested to play a role in the maintenance of the disorder (Clark & Wells, 1995; Wild & Clark, 2011). Therefore, working with specific, past events, characterized by social anxiety, has been the focus of recent interventions using imagery rescripting techniques (e.g. Frets et al., 2014; Wild & Clark, 2011; Wild et al., 2007; 2008). The present study supports

these initiatives in showing that individuals with SAD in particular, and more so than individuals with PD, experience SA-cued memories as central to their identity. Furthermore, when an individual recalls a negative autobiographical memory and perceives this as central to their identity, this could be understood as fusion with, or a lack of distance to, the mental content elicited by the memory. Thus, another line of potentially interesting work in this area is represented in contemporary cognitive therapies using distancing or decentering techniques (e.g., Acceptance and Commitment Therapy; Hayes Strosahl, & Wilson, 2012; Emotion Regulation Therapy; Mennin & Fresco, 2014; Mindful- and Acceptance-based Behavioral Therapy, Roemer & Orsillo, 2009). Across memory type, individuals with anxiety disorders reported past anxious events as having a high traumatic impact, as being central to the identity, and as contributing more to their present condition. As such, working with memories of past negative, anxiety-provoking events may be a valuable way into understanding the functionality of present distorted cognitions, not only for individuals with SAD, but likely also for individuals with PD. Future research should further investigate the role of negative, anxious memories in PD and how they relate to the present emotions and cognitions. Furthermore, investigating how traditional CBT (e.g., Clark & Beck, 2010) impacts these variables associated with the perception and meaning of past negative events may shed light on important treatment mechanisms.

Important limitations should be highlighted. First, although diagnostic interviews were peer-supervised by experienced clinicians, no formal reliability measure of diagnoses was obtained. In addition, a number of the clinical participants had comorbid anxiety disorders, which questions the internal validity of the findings. However, excluding participants with comorbidity was not possible due to the relatively small sample size. Secondly, all measures were based on self-report measures, which have known limitations. Specifically for this study, the self-report measures may explain the disorder-congruent retrieval of memories. Should one be interested in decreasing this self-report recall bias, an interview-based methodology may be suited for this, although such an approach might have to take audience tuning into account to a greater extent than self reports (Echterhoff, Higgins, Groll, 2006). Thirdly, we did not include memories cued by neutral phrases, and the ANOVAs were conducted on uneven sample sizes. Finally, the large number of comparisons increases the risk of a Type I error, and results should be interpreted with regard to their effect sizes.

5. Conclusions

PA-cued memories were generally rated higher than SA-cued memories on a number of autobiographical memory properties, and participants experienced these events as more central to their identity and having a higher traumatic impact. Participants with SAD were more likely to hold SA-cued memories central to their identity, but overall, participants with anxiety disorders differed from HCs but not from each other. Therapeutically addressing past negative events may be an important component in understanding the functionality of present distorted cognitions in anxiety disorders such as SAD and PD.

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Conflict of interest

The authors declare no conflict of interest.

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Figure 1: Depicting social anxiety (SAem) and panic anxiety (PAem) emotional intensity in social anxiety-cued (SAmem) and panic anxiety-cued (PAmem) memories. Error bars represent standard errors. HC = Healthy control; PD = Panic Disorder; SAD = Social anxiety disorder
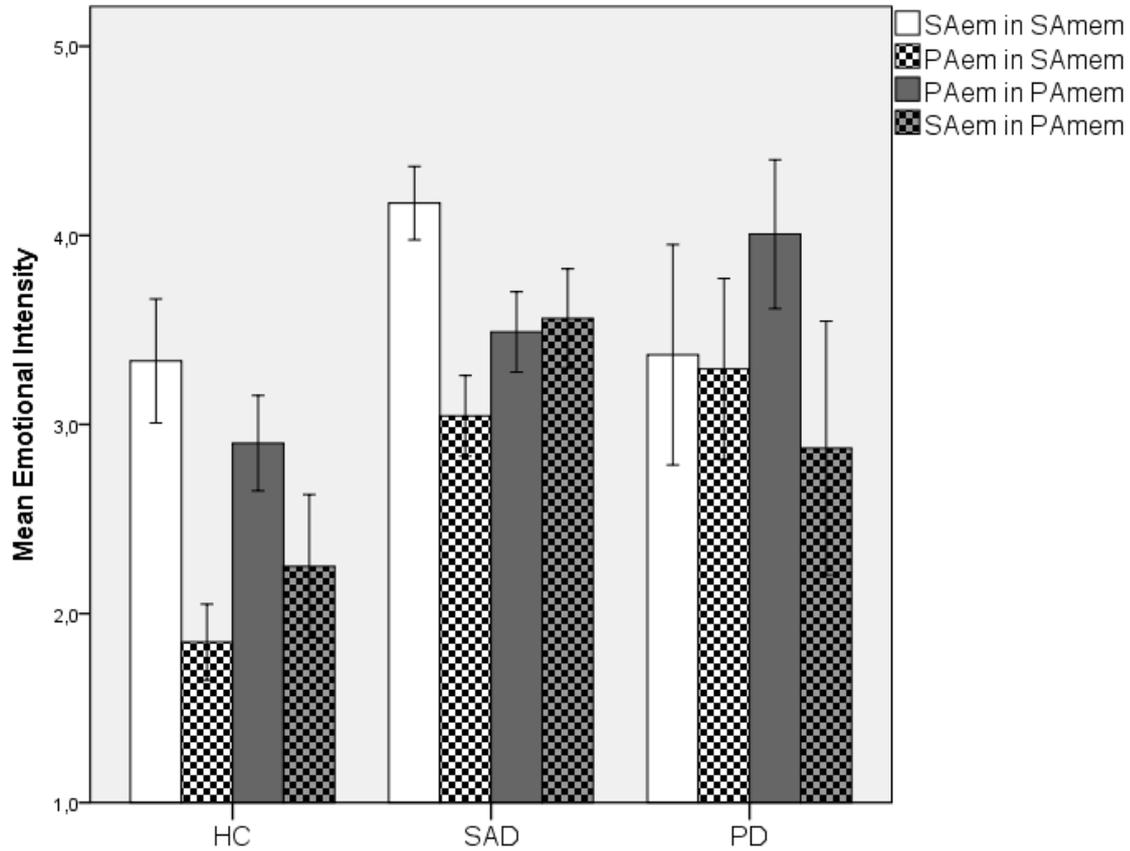
Table 1

Autobiographical memory questions

1. (Reliving) While remembering the event, I feel as though I am reliving the original event (1 = not at all; 7 = to a very high degree)
2. (Visual) While remembering the event, I can see it in my mind (1 = not at all; 7 = to a very high degree)
3. (Auditory) While remembering the event, I can hear it in my mind (1 = not at all; 7 = to a very high degree)
4. (Olfactory) While remembering the event, I can smell or taste it in my mind (1 = not at all; 7 = to a very high degree)
5. (Surroundings) While remembering the event, I recall the physical surroundings (1 = not at all; 7 = to a very high degree)
6. (Vividness) This memory is vivid (1 = not at all; 7 = to a very high degree)
7. (Bodily sensations) While remembering the event, I feel the particular bodily sensations I felt then (1 = not at all; 7 = to a very high degree)
8. (Emotions) While remembering the event, I feel the particular emotions, I felt then (1 = not at all; 7 = to a very high degree)
9. (Valence) The emotions I have when I recall the episode are (-3 = extremely negative; 3 = extremely positive)
10. (Current intensity) The emotions I have when I recall the episode are intense (1 = not at all; 7 = to a very high degree)
11. (Perspective) When I recall the event, I primarily see what happened from a perspective as seen through (1 = my own eyes; 7 = an observer's eyes)
12. (Belief) I believe that the event really took place the way I remember it, and that I did not imagine anything or invent anything that did not take place (1 = 100% fantasy; 7 = 100% real).
13. (Words) When I recall the event, it comes to me in words (1 = not at all; 7 = to a very high degree)
14. (Worry) When I recall the event, I worry about it happening again (1 = not at all; 7 = to a very high degree)
15. (Voluntary recall) Since it happened, I have deliberately chosen to think back to the event in my mind (1 = not at all; 7 = to a very high degree)
16. (Involuntary recall) Since it happened, this memory has popped into my mind by itself, that is without me trying to recall it (1 = not at all; 7 = to a very high degree)

Table 2

Participant descriptives

	HC (N=29)	SAD (N = 58)	PD (N = 20)
Age	29.1 (3.9)	32.8 (9.9)	33.9 (10.0)
Gender (percent women)	76%	59%	80%
BDI[***a]	2.3 (3.6)	22.1 (11.3)	18.0 (12.3)
BAI[***a]	2.6 (3.1)	21.2 (11.4)	26.5 (13.7)

Note. BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory; HC = Healthy control; PD = Panic Disorder; SAD = Social anxiety disorder.

***: p < .001. a: (SAD = PD) > HC.

Table 3

Percentages of cue-congruent memories retrieved by the three groups

Group	% SA-cue congruent memory	% PA-cue congruent memory
SAD	87	52
PD	40	79
HC	95	69

Table 4

Means and standard deviations in the three groups

	HC	SAD	PD
	M(SD)	M(SD)	M(SD)
	Across memory types | SA / PA	Across memory types | SA / PA	Across memory types | SA / PA
Age at event	19.9 (4.9) | 17.6 (6.0) / 22.2 (5.7)	22.2 (7.9) | 22.1 (8.9) / 22.3 (10.1)	26.4 (10.3) | 25.3 (11.5) / 27.5 (10.2)
Intensity (past)	5.5 (.8) | 5.1 (1.1) / 6.0 (1.9)	6.4 (.6) | 6.3 (.9) / 6.5 (.7)	6.1 (.9) | 5.9 (1.1) / 6.4 (.9)
Reliving	2.8 (1.5) | 2.8 (1.6) / 2.9 (1.4)	4.5 (1.4) | 4.6 (1.6) / 4.4 (1.5)	4.3 (1.9) | 4.2 (1.9) / 4.4 (2.1)
Visual	4.4 (1.2) | 4.2 (1.3) / 4.7 (1.4)	5.6 (1.2) | 5.6 (1.4) / 5.6 (1.3)	5.7 (1.3) | 5.5 (1.4) / 5.8 (1.3)
Auditory	2.3 (1.3) | 2.4 (1.5) / 2.2 (1.5)	3.7 (1.6) | 3.7 (2.0) / 3.7 (1.8)	3.4 (1.9) | 3.0 (1.3) / 3.9 (2.1)
Olfactory	1.5 (.9) | 1.4 (.9) / 1.6 (1.2)	2.3 (1.4) | 2.6 (1.7) / 2.0 (1.4)	2.6 (1.7) | 2.5 (1.8) / 2.7 (1.8)
Surroundings	4.9 (1.3) | 4.8 (1.4) / 5.0 (1.5)	5.4 (1.3) | 5.4 (1.6) / 5.5 (1.5)	5.3 (1.4) | 4.9 (1.8) / 5.7 (1.5)
Vividness	4.1 (1.5) | 3.9 (1.5) / 4.3 (1.6)	5.4 (1.3) | 5.3 (1.4) / 5.8 (1.4)	5.5 (1.4) | 5.3 (1.5) / 5.8 (1.6)
Bodily sensations	2.1 (1.3) | 2.1 (1.4) / 2.1 (1.4)	3.9 (1.6) | 3.9 (1.8) / 3.9 / 1.8)	3.9 (1.8) | 3.6 (1.8) / 4.2 (2.2)
Feelings (same)	2.4 (1.3) | 2.4 (1.5) / 2.4 (1.5)	4.5 (1.5) | 4.7 (1.7) / 4.4 (1.6)	4.1 (1.9) | 3.8 (1.9) / 4.4 (2.1)
Valence	-1.0 (.8) | -.9 (1.1) -1.0 (.9)	-2.1 (.7) | -2.1 (.8) / -2.1 (1.0)	-2.0 (1.1) | -1.9 (1.2) / -2.0 (1.0)
Current intensity	2.7 (1.3) | 2.7 (1.6) / 2.8 (1.2)	4.7 (1.4) | 4.7 (1.6) / 4.8 (1.5)	4.6 (1.9) | 4.4 (1.9) / 4.9 (2.0)
Perspective	3.0 (1.6) | 3.1 (1.6) / 3.0 (1.8)	3.0 (1.6) | 3.1 (1.7) / 2.9 (1.8)	3.1 (1.6) | 3.2 (1.8) / 3.0 (1.8)
Words	2.3 (1.3) | 2.2 (1.4) / 2.3 (1.5)	2.6 (1.2) | 2.6 (1.4) / 2.6 (1.4)	2.7 (1.7) | 2.7 (1.9) / 2.7 (1.9)
Belief	6.0 (.9) | 5.9 (1.2) / 6.2 (.9)	6.4 (.6) | 6.3 (.9) / 6.5 (.8)	6.5 (1.0) | 6.4 (1.3) / 6.6 (.9)
Worry	2.3 (1.1) | 2.1 (1.4) / 2.6 (1.2)	5.0 (1.5) | 4.9 (1.9) / 5.2 (1.6)	5.4 (1.5) | 5.1 (1.7) / 5.7 (1.7)
Voluntary recall	2.2 (1.0) | 2.1 (1.2) / 2.4 (1.2)	3.1 (1.3) | 3.2 (1.5) / 3.0 (1.5)	2.7 (1.4) | 2.7 (1.3) / 2.8 (1.8)
Involuntary recall	2.5 (1.1) | 2.3 (1.2) / 2.8 (1.4)	4.3 (1.3) | 4.3 (1.5) / 4.3 (1.4)	4.0 (1.7) | 3.8 (1.8) / 4.1 (1.8)
Centrality	1.8 (.8) | 1.5 (.8) / 2.1 (1.0)	3.3 (.8) | 3.2 (.9) / 3.3 (.9)	3.1 (.9) | 2.9 (.9) / 3.4 (1.1)

Contribution to present condition?		4.7 (1.6) | 4.6 (1.8) / 4.8 (1.8)	5.1 (1.2) | 4.7 (1.5) / 5.5 (1.5)
		4.6 (1.7) | 4.8 (2.1) / 4.4 (1.9)	5.3 (1.4) | 5.4 (1.8) / 5.1 (1.8)
Traumatic impact	1.5 (.6) | 1.4 (.5) / 1.5 (.7)	3.6 (1.2) | 3.5 (1.5) / 3.6 (1.2)	3.5 (1.5) | 3.2 (1.4) / 3.7 (1.7)

Note. HC = Healthy control; PD = Panic Disorder; SAD = Social anxiety disorder.

Table 5

Main results from the Mixed 3 Group (HC, SAD, PD) x 2 Memory (SA-cued vs. PA-cued) ANOVAs

	Main effects				Interaction effect	
	Within-effect		Between-group effect		Memory x Group	
	F	η_p^2	F	η_p^2	F	η_p^2
Age	**6.0**[*a]	.06	**4.1**[*c]	.07	2.3	.04
Intensity (past)	**16.1**[***a]	.13	**14.8**[***d]	.22	2.9	.05
Reliving	< .1	<.01	**12.3**[***d]	.19	1.2	.02
Visual	**4.2**[*a]	.04	**9.6**[***d]	.16	1.1	.02
Auditory	2.0	.02	**7.1**[**d]	.12	2.4	.04
Olfactory	.2	<.01	**5.1**[**d]	.09	**5.2**[**]	.09
Surroundings	**6.3**[*a]	.06	1.7	.03	1.7	.03
Vividness	**10.6**[**a]	.09	**10.8**[***d]	.17	.3	<.01
Bodily sensations	1.8	.01	**14.4**[***d]	.21	1.3	.03
Feelings (same)	.5	.01	**18.2**[***d]	.26	2.9	.05
Valence	.2	<.01	**18.4**[***e]	.26	.2	<.01
Current intensity	3.1	.03	**18.2**[***d]	.26	.9	.02
Perspective	.6	.01	< .1	< .01	< .1	< .01

Words	< .1	<.01	.7	.01	.2	< .01
Belief	3.1	.03	2.7	.05	.4	.01
Worry	**7.6**[**a]	.07	**42.2**[***d]	.45	.3	.01
Voluntary recall	.1	<.01	**5.0**[**f]	.09	.7	.01
Involuntary recall	3.1	.03	**17.4**[***d]	.25	.8	.02
CES	**19.3**[***a]	.16	**31.9**[***d]	.38	**4.6**[*]	.08
Contribution to present condition?	**4.8**[*a]	.06	1.3	.02	1.7	.02
PCL	**7.6**[**a]	.07	**34.0**[***d]	.40	1.5	.03

Note. F-values in bold refer to significant results. HC = Healthy control; PD = Panic Disorder; SAD = Social anxiety disorder. a: PA-cued memory rated higher; b: SA-cued memory rated higher; c: PD > (SAD=HC); d: (SAD = PD) > HC; e: (SAD = PD) < HC; f: SAD > HC, SAD = PD, PD = HC.

p < .05. **p* < .01 ***p* < .001.