Accepted Manuscript

Autobiographical memory retrieval and appraisal in social anxiety disorder

David A. Moscovitch, Vanja Vidovic, Ariellae P. Lenton-Brym, Jessica R. Dupasquier, Kevin C. Barber, Taylor Hudd, Nick Zabara, Mia Romano

Please cite this article as: Moscovitch, D.A., Vidovic, V., Lenton-Brym, A.P., Dupasquier, J.R., Barber, K.C., Hudd, T., Zabara, N., Romano, M., Autobiographical memory retrieval and appraisal in social anxiety disorder, *Behaviour Research and Therapy* (2018), doi: 10.1016/j.brat.2018.06.008.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Autobiographical Memory Retrieval and Appraisal in Social Anxiety Disorder

David A. Moscovitch, Vanja Vidovic, Ariella P. Lenton-Brym, Jessica R. Dupasquier, Kevin C.

Barber, Taylor Hudd, Nick Zabara, & Mia Romano

Department of Psychology and Centre for Mental Health Research, University of

Waterloo

Correspondence concerning this article should be addressed to David A. Moscovitch,

Department of Psychology and Centre for Mental Health Research, University of Waterloo;

Waterloo, Ontario, Canada N2L-3G1. Contact: dmosco@uwaterloo.ca.

Ariella Lenton-Brym is currently at Ryerson University in Toronto, Canada.

Abstract

Individuals with social anxiety disorder (SADs; $n = 41$) and healthy controls (HCs; $n = 40$) were administered the *Waterloo Images and Memories Interview*, in which they described mental images that they tend to experience in both anxiety-provoking and non-anxiety-provoking social situations and then recalled, in as much detail as possible, specific autobiographical memories of salient aversive and non-aversive social experiences that they believed led to the formation of these images. Participants' audio-recorded memory narratives were transcribed and coded based on the procedure of the *Autobiographical Interview*, which provides a precise measure of the degree of episodic detail contained within each memory. Participants also rated the subjective properties of their recalled memories. Results revealed that participants across the two groups retrieved equivalent rates of both aversive and non-aversive social memories. However, SAD participants' memories of aversive events contained significantly more episodic detail than those of HCs, suggesting that they may be more highly accessible. Moreover, participants with SAD appraised their memories of aversive experiences as more distressing and intrusive than HCs, and perceived them as having a significantly greater influence on their self-perception. In contrast, no group differences were observed for memories of non-aversive events. Findings have the potential to shed new light on autobiographical memory in SAD, with possible implications for psychotherapeutic intervention.

Keywords: social anxiety; mental imagery; autobiographical memory; specificity; episodic; semantic

Highlights

- Examined aversive/non-aversive memory retrieval in social anxiety disorder (SAD)

- SADs and controls equally accessed aversive and non-aversive memories

- SADs' aversive memories contained richer episodic detail than those of controls

- SADs appraised aversive memories as more distressing, intrusive, and self-relevant

- No group differences observed in recall or appraisals of non-aversive memories

Autobiographical Memory Retrieval and Appraisal in Social Anxiety Disorder

1. Introduction

Social anxiety disorder (SAD) is a highly prevalent, disabling, and difficult-to-treat problem characterized by anxious preoccupation with the prospect of social scrutiny and evaluation (American Psychiatric Association, 2013; Stein & Stein, 2008). At its core, social anxiety is fueled by negative self-perception (Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997). Socially anxious individuals perceive themselves as socially incompetent, visibly anxious, and/or physically unattractive, and they worry that these unappealing flaws might be exposed to critical others within social contexts (Moscovitch, 2009). When self-evaluative concerns become salient in social and interpersonal situations, people with SAD initiate self-concealment behaviours, elude engagement with others, and withdraw from the social arena (Moscovitch et al., 2013; Plasencia, Alden, & Taylor, 2011). These avoidance strategies, in turn, induce negative evaluation from others, resulting in diminished social support and increased functional impairment (Plasencia, Taylor, & Alden, 2016; Rowa et al., 2015).

In recent years, advancements in social anxiety research have bolstered our understanding of the interactive cognitive-behavioural processes underlying the development, persistence, and treatment of SAD (e.g., Weeks, 2014). However, many important questions remain unanswered. One such set of questions, which the current study aims to address, focuses on the nature of autobiographical memory recall in SAD. As reviewed by Morgan (2010), more than two decades of research has found little consistent evidence in support of autobiographical memory biases in SAD despite their presumed central role in the development and maintenance of social anxiety symptoms (Clark & Wells, 1995; Rapee & Heimberg, 1997). Nevertheless, it may be premature to conclude that such memory biases do not exist, as our ability to draw firm conclusions based

on the current literature has been hindered by inconsistencies in how key memory outcomes have been operationalized and measured in previous studies (for a comprehensive review of this literature, see Zlomuzica et al., 2014). Here, we aim to apply a fresh lens to this field of study. To do so, we draw upon evidence supporting the intimate link between autobiographical memories and mental images in SAD, which has helped to spawn methodological advances in the conceptualization and measurement of biases in autobiographical memory specificity, recall, and appraisal.

Socially anxious people commonly report the experience of unpleasant negative mental images before, during, and after socially threatening events (Chiupka, Moscovitch, & Bielak, 2012) in which they envision themselves behaving in an anxious and/or socially awkward manner (e.g., Hirsch, Clark, & Mathews, 2006). These images are exaggerated and distorted, but socially anxious individuals perceive them as meaningful and accurate representations of how others view them during interpersonal encounters (Hackmann & Holmes, 2004; Hirsch, Clark, Mathews, & Williams, 2003).[1] Pioneering research by Hackmann and colleagues using semi-structured interviews demonstrated that people with SAD routinely trace the formation of their negative self-images to *specific autobiographical memories* of past distressing social experiences that coincided with the onset or worsening of their symptoms (Hackmann, Clark, & McManus, 2000; Hackmann, Surawy, & Clark, 1998). While considerable experimental and clinical research has highlighted the important role of negatively biased mental imagery in the emotional disorders in general (e.g., Holmes & Mathews, 2010) and SAD, in particular (e.g., Stopa, 2009),

---

[1] Though low-anxious individuals might also experience negative image instruions in anxiety-provoking social situations, they tend to cope with such intrusions in a more adaptive manner (for example, by spontaneously modifying their negative perceptual features within their imagination), which helps to inhibit negatively biased interpretations of their meaning and mitigate anxious distress (Moscovitch, Chiupka, & Gavric, 2013; Moscovitch, Gavric, Merrifield, Bielak, & Moscovitch, 2011).

our current understanding of the nature and impact of autobiographical memories in SAD

remains significantly underdeveloped (see Morgan, 2010; Moscovitch, 2016; Zlomuzica et al.,

2014).

Autobiographical memory is a type of episodic memory that involves explicit

recollections of personal life events that occurred at a particular time and place; in contrast,

semantic memory encodes and stores information pertaining to general knowledge about

ourselves and the world that does not involve re-experiencing past events (Tulving, 1972; 1985;

1989). For example, "I am socially incompetent" is a semantic memory that relies on one's

retrieval of general schema-based self-knowledge. Conversely, "my face turned red when I

presented in front of the class in sixth grade" is an episodic memory that relies on one's

awareness of oneself as a continuous entity across time who experienced that particular episode

at that particular time (Romano, Ma, Moscovitch, & Moscovitch, in press).

Recent findings support the notion that participants with high levels of trait social anxiety

or SAD can readily recall specific anxiety-related autobiographical memories of negative past

personal events, which they perceive as being self-defining and central to their identity (Krans,

de Bree, & Bryant, 2014; Krans et al., 2017; Moscovitch et al., 2011; O'Toole, Watson,

Rosenberg, & Berntsen, 2016; Wenzel & Cochran, 2006). Given that these autobiographical

memories are likely to contribute to the negative views of self that lie at the heart of the disorder,

there is good reason to suspect that investigating their nature and impact with improved measures

might help to elucidate why negative self-appraisals are so pervasive and resistant to change in

SAD, even in the face of corrective feedback (see Koban et al., 2017). Such research could also

provide important clues for how psychotherapeutic interventions may be optimized to target

socially traumatic memories (Lane, Ryan, Nadel, & Greenberg, 2015).

Autobiographical memory biases in the emotional disorders have been most commonly studied via the *Autobiographical Memory Test* (AMT; Williams & Broadbent, 1986), a widely used memory cuing paradigm, but one that has come under increasing methodological scrutiny and criticism. As reviewed by Griffith and colleagues (2012), various crucial aspects of AMT administration have not been properly standardized across studies, including the modality in which memory cues have been presented (e.g., in oral, visual, or written forms); the cue word lists and their characteristics; the application of response time limits; and the scoring procedures and criteria – all factors which may affect the way memories are retrieved and findings are interpreted.

Seeking an alternative to the AMT, we developed the *Waterloo Images and Memories Interview* (WIMI; Moscovitch et al., 2011), a structured assessment in which trained interviewers elicit narrative descriptions of participants' mental images and associated autobiographical memories. Narratives are audio-recorded and transcribed, then coded by trained research assistants blind to the group status of participants based on the meticulous procedure of the *Autobiographical Interview* (AI; Levine, Svoboda, Hay, Winocur, & Moscovitch, 2002). The AI coding enables fine-grained distinctions between episodic and semantic memory details for each grammatical clause within the narrative. Following AI protocol, details are coded segment-by-segment as being *internal* when they describe any episodic aspect of a specific event occurring at a particular time and place. Conversely, *external* details consist of general facts and semantic knowledge that do not require recollection of a specific event occurring at a particular time and place. Since external details do not carry any essential information about the recollected episode itself, it is the amount of internal detail *per se* that determines how rich the episodic memory actually is. Thus, while the AMT compels researchers to code participants' retrieved memories

in a global and dichotomized fashion as being either *overgeneral* or *specific* (e.g., to determine *whether* or *not* participants are capable of retrieving specific autobiographical memories that occurred at specific times and places), the AI coding system enables researchers to delve deeper into the narrative structure and characteristics of endorsed memories in order to determine whether they may be enhanced or degraded in particular types of detail (e.g., to determine *how much* episodic detail participants retrieve in their specific autobiographical memories).

The AI has recently been applied to investigate the memory characteristics of individuals with clinical diagnoses of Major Depressive Disorder and Posttraumatic Stress Disorder . Studies of depression that have relied on the AMT have classically shown that when cued with emotional words, depressed individuals preferentially retrieve overly general or repeated memories rather than specific memories of events that occurred at a particular time and place (see Watkins & Teasdale, 2001; Williams et al., 2007). This pattern of findings has since been extended through the application of the AI coding scheme to memory narratives of depressed vs. non-depressed individuals by showing that depressed participants, relative to non-depressed controls, possessed unique deficits in recalling *internal* episodic memory details, and that these impairments did not extend to external details (Söderlund et al., 2014). A subsequent study using the AI to examine traumatic and non-traumatic memories in individuals with and without PTSD enhanced our understanding of memory in PTSD by demonstrating that autobiographical memories of traumatic events were characterized by significant enhancements in the recall of internal episodic detail but that such enhancements occurred for traumatic memories irrespective of participants' PTSD status. Additionally, participants with and without PTSD were distinguishable only by the amount of external details contained within their memory narratives, with external detail enhancements observed only in those participants with PTSD (McKinnon et al., 2015). Thus,

studies that have relied on the AI to study autobiographical memory biases in the emotional disorders have begun to yield intriguing outcomes that shed new light on previously uninvestigated aspects of episodic memories in depression and PTSD that cannot be detected by the AMT.

There are several possible outcomes of interest. It is possible that, like traumatic memories in people with and without PTSD (McKinnon et al., 2015), negative autobiographical memories in SAD may also be characterized by enriched episodic detail; indeed, previous research has suggested that PTSD-relevant traumatic memories and SAD-relevant socially traumatic memories share similar characteristics (Carleton, Peluso, Collimore, & Asmundson, 2011; Erwin, Heimberg, Marx, & Franklin, 2006). If we indeed find that memories of aversive past experiences in SAD are retrieved in more episodic detail, such memories would be expected to be highly accessible and exert a strong impact on socially anxious individuals' emotions and self-attitudes than less detailed memories. Moreover, in light of the well-documented overlap in the cognitive and affective substrates of SAD and depression (e.g., Moscovitch, Hofmann, Suvak, & In-Albon, 2005), it is also plausible that autobiographical memories retrieved by people with SAD would be degraded in episodic detail, particularly for memories of past positive social experiences, thus dampening the accessibility and potential salutary impact of such memories and providing further evidence in support of the "positivity deficits" hypothesis in social anxiety (Kashdan, Weeks, & Savostyanova, 2011). Finally, it is possible that the autobiographical memories of those with SAD might also consist of more negatively-valenced external details, perhaps demonstrating that memory content in SAD is heavily imbued with non-specific self-knowledge derived primarily from negative self-schemas, like for those with PTSD (McKinnon et al., 2015). Testing these fine-grained hypotheses about the episodic richness of

specific autobiographical memories in SAD requires researchers to assess and operationalize memory details in a deeper and more nuanced manner than the globally dichotomized outcomes produced by the coding procedures of the AMT.[2]

Using the WIMI coupled with the coding scheme of the AI, we have begun to investigate the nature of episodic memory retrieval in social anxiety. In an initial study (Moscovitch et al., 2011), we administered the WIMI to investigate images and memories experienced in both aversive and non-aversive social contexts (i.e., those in which participants reported feeling anxious and distressed, and those in which participants reported feeling comfortable and content). We found that negative images and memories were commonly endorsed by individuals across the full spectrum of trait social anxiety. However, negative images were more emotionally impactful and appraised more negatively when retrieved by high socially anxious individuals. When we blind-coded the image and memory narratives using the AI coding scheme, we discovered that non-negative images were significantly impoverished in episodic detail for high socially anxious participants only. Moreover, participants with higher levels of social anxiety differed significantly from their low anxiety counterparts in their subjective appraisals of negative images. Unexpectedly, these group differences in episodic detail and subjective appraisals of negative images did not extend to associated negative memories. It is possible that the absence of group differences in the appraisal and retrieval of negative memories in our original study was due to our use of a younger, undergraduate nonclinical sample, and that stronger group differences would emerge if the WIMI were to be administered to an older, community sample of participants with a clinical diagnosis of SAD. Alternatively, it is also

---

[2] Of note, the AI coding framework examines the detailedness of memories rather than their specificity per se. For example, a specific memory could be coded on the AI as having low internal detail and a non-specific memory as having high internal detail. The present study was designed to assess the retrieval and detailedness of specific memories only (i.e., those that participants endorsed on the WIMI as having occurred at a specific time and place).

possible that unique patterns of negative memory appraisal and retrieval are not as important in the phenomenology of SAD as we might have believed, no matter which memory measures and procedures are used.

In the present study, we trained independent interviewers to administer the WIMI individually to participants with SAD and healthy controls (HCs). Aversive and non-aversive memories were retrieved and subjectively appraised by participants and memory narratives were later blind-coded and scored by research assistants based on the AI procedures. We advanced three hypotheses. First, based on our previous findings that, irrespective of their social anxiety levels, the vast majority of WIMI participants can retrieve specific autobiographical memories of aversive past social experiences when cued by negative imagery (e.g., Moscovitch et al., 2011), we predicted that participants with SAD and HCs would retrieve an equivalent number of mental images and associated specific autobiographical memories across both aversive and non-aversive events. Second, we expected to observe a double dissociation across groups in the types of details participants would retrieve in their aversive vs. non-aversive specific memories, and in the way aversive vs. non-aversive specific memories would be appraised. Specifically, we hypothesized that aversive memories would be recollected in greater internal episodic detail and would impact those with SAD *more negatively* than HCs, and that non-aversive memories would be retrieved in impoverished internal episodic detail and impact participants with SAD *less positively* than HCs. Finally, we tested the hypothesis that aversive memories retrieved by SAD participants would contain more negative external details reflecting the input of non-specific self-knowledge derived from negative self-schemas.

2. Method

2.1 Participants

The study sample consisted of 81 participants, 41 of whom met DSM-5 (American Psychiatric Association, 2013) criteria for a current principal diagnosis of SAD, and 40 of whom were HCs without a history of significant mental health concerns. Participants, including HCs, were recruited from the community via online and paper advertisements. The SAD group was, on average, 30.97 years old (SD = 12.6) and was comprised of 65.9% females, with 48.1% identifying as White/European, 18.5% as Asian, 7.4% as South Asian, 7.4% as Latin American, 3.7% as Black, and 11.1% as Other. The HC group was, on average, 30.2 years old (SD = 15.1) and consisted of 65.0% females, with 65.7% identifying as White/European, 17.1% as Asian, 8.6% as South Asian, none as Latin American or Black, and 5.7% as Other.

2.2. Diagnostic assessment

All potentially eligible participants in both groups were screened for symptoms of social anxiety and exclusion criteria using an online questionnaire and subsequent phone screen adapted from the *Mini International Neuropsychiatric Interview* (MINI; Sheehan, 2014), a well-validated semi-structured diagnostic interview (Pinninti, Madison, Musser, & Rissmiller, 2003; Sheehan et al., 1998). In order to establish diagnoses, participants who endorsed symptoms on the phone screen consistent with a diagnosis of SAD were invited to the lab, where the MINI was administered by trained interviewers. Individuals who denied symptoms during screening were enrolled in the study as HCs. To augment our diagnostic assessment, we appended the MINI with symptom checklists adapted from the *Anxiety Disorders Interview Schedule* (ADIS; Brown & Barlow, 2014). Exclusion criteria for the clinical group included endorsement of active and clinically significant suicidality, mania, psychosis, or substance abuse or dependence. Exclusion criteria for the HC group included endorsement of any symptoms that could reasonably have met DSM diagnostic criteria for a mental disorder.

Interviewers were clinical psychology graduate students trained extensively in psychological assessment, with all cases reviewed by two licensed clinical psychologists. The principal diagnosis was the one deemed most clinically interfering and/or distressing. Interrater agreement on the principal diagnosis was 100% for a subset of interviewers who met independently on two separate occasions with a subsample of 10 clinical participants. Within the clinical sample, 27 participants (65.9%) received an additional diagnosis secondary to principal SAD, with 1.17 (SD = 1.07) mean additional diagnoses per participant. The most common additional diagnoses were Generalized Anxiety Disorder (n = 8; 19.5%), Major Depressive Disorder (n = 8; 19.5%), Persistent Depressive Disorder (n = 6; 14.6%), and Obsessive-Compulsive Disorder (n = 3; 7.3%).

2.3 Administration of the WIMI

Each session began with the *WIMI preamble*, designed to orient participants to the WIMI and operationalize the constructs of interest (for the full script, see Moscovitch et al., 2011). Participants were then asked whether they experience any typically-recurring mental images during anxiety-provoking social situations and during non-anxiety provoking social situations. Participants were subsequently asked whether they have any autobiographical memories of specific social events that occurred at a particular time and place that they perceive as being related to the reported images. Participants provided narrative descriptions of these experiences under two conditions – *recall* and *specific probe* (described below) - that reflect differing levels of interviewer cuing and probing. Time of administration of the WIMI lasted approximately 60 minutes per participant. Scheduling and administering the interview were always performed independently by different lab personnel to maintain the diagnostic blindness of the WIMI interviewer.

2.3.1 Recall and specific probe conditions

Participants who endorsed experiencing images and/or memories initially provided information about these experiences within the recall condition, in which interviewers solicited descriptive narratives in a completely open-ended manner without any probing or cuing. After they finished speaking, participants were provided with a general probe, in which they were asked whether there were any further details they wished to provide. After completion of the recall and general probes for both images and memories endorsed in anxiety-provoking and non-anxiety provoking social situations, participants were administered a specific probe for each type of image and memory they endorsed, in which the interviewer asked several follow-up questions about their initial description to elicit more elaborate detail.

2.3.2 Rules for order of WIMI administration

Probing about aversive and non-aversive images and memories occurred in a counterbalanced order across participants. Probes about images always preceded probes about memories. If participants denied experiencing an image for either valence, the corresponding memory section was not administered. The recall condition for all images and memories occurred first, followed by the probes for all images and memories endorsed.

2.4 Coding of participant narratives

Audio-recorded memory narratives were transcribed and coded across predetermined categories by trained research assistants who were blind to study hypotheses and the group status of participants. Each WIMI narrative was coded according to a standardized system based on the AI (Levine et al., 2002). Coders first identified the "main event" discussed in the narrative, then divided narratives into individual details representing separate utterances or grammatical clauses, and coded each detail as being either "internal" or "external" in a manner consistent with the

definitions described earlier. Finally, coders identified the valence of each internal and external detail as positive, negative, or neutral. Examples of coded memory narratives are provided in the Appendix.

2.5 Coder training and reliability

Five research assistants (RAs) were trained to reach agreement with an expert coder, author ALB. In line with the methodology used in Moscovitch et al. (2011), each of the RAs independently coded eight *reliability narratives*, and were required to obtain 80% agreement with ALB for internal and external details, respectively, and 90% agreement for total details. Two coders who initially did not meet these cutoffs coded two additional narratives, after which all coders met the established reliability cutoff. Intraclass correlation coefficients (ICCs; absolute agreement; two-way mixed model) were calculated between ALB and each new coder's totals. Two-way ICCs ranged from .82 to .98 for internal details and external details. For total details, two-way ICCs ranged from .98 to .99. Following the training phase, participants' remaining narratives were placed in a common pool and scored at random by coders who worked independently. To minimize potential coder drift, coders were required to finish coding their narratives within 6 weeks of completing reliability training. Following the completion of all coding, ALB doublechecked a random subset of each coder's coded narratives for accuracy.

2.6 Subjective memory ratings

Participants rated various characteristics of their memories immediately after the completion of the recall condition for each type of memory endorsed, including perceived memory vividness (*While envisioning/remembering the event, I could see it clearly in my mind*) and memory intrusiveness (*This memory has previously come to me out of the blue, without my trying to bring it to mind*), as well as the perceived impact of the recollected event on their

perception of themselves (*The event just discussed influenced how I view myself*) on Likert-type

scales from 1 (not at all) to 9 (extremely). Participants also rated the emotional impact of

retrieving each memory on measures of negative affect and positive affect, which consisted of 10

emotion adjectives from each subscale of the *Positive and Negative Affect Schedule* (PANAS;

Watson, Clark, & Tellegen, 1988). The instructions for the PANAS were modified so that

participants were asked to reflect on how much they felt a certain way (e.g., interested, proud,

embarrassed, nervous, etc.) while remembering the event in question. The 10 positive and 10

negative emotion adjectives were sum-scored separately across participants for analyses. Finally,

after the recall of each memory, participants estimated how long ago the event occurred.

2.7 Self-report measures

Participants completed self-report measures immediately after the administration of the

WIMI. The *Social Phobia Inventory* (SPIN; Connor et al., 2000) is a well-validated measure of

social anxiety symptoms (Antony, Coons, McCabe, Ashbaugh, & Swinson, 2006), which

demonstrated strong internal consistency in the current study ($\alpha = .96$). The depression subscale

of the *Depression Anxiety Stress Scale - Short Version* (DASS 21; Lovibond & Lovibond, 1995)

is a valid and reliable measure of depression symptoms (Antony, Bieling, Cox, Enns, &

Swinson, 1998), which also showed strong reliability in the present study ($\alpha = .93$). The Verbal

section of the *Shipley Institute for Living Scale* (SILS; Shipley, 1940; Zachary, 1986) requires

respondents to choose the correct definition of a target word from four possibilities and was

administered to ensure that any observed group differences in WIMI performance could not be

attributed to differing cognitive or verbal abilities.

3. Data analytic plan and data preparation

3.1 Hypothesis testing

To test our first hypothesis that participants with SAD and HCs would retrieve an equivalent number of specific aversive autobiographical memories across both aversive and non-aversive events, chi-square analyses were conducted. These assessed the extent to which participants between the two groups endorsed (i.e., said "yes, I experience those") versus denied (i.e., said "no, I do not experience those") having images and associated specific memories for aversive and non-aversive events.

To test our second hypothesis that aversive memories would be recollected in greater internal episodic detail and would impact those with SAD more negatively than HCs, and that non-aversive memories would be retrieved in impoverished internal episodic detail and impact participants with SAD less positively than HCs, a series of repeated-measures ANOVAs were conducted with Group (SAD vs. HC) as the between-subjects factor and Memory Valence (aversive vs. non-aversive memories) as the within-subjects variable. Internal memory details, external memory details, and subjective memory ratings served as the dependent variables in separate analyses. As in Söderlund et al. (2014), internal and external details were summed across levels of probing (recall + probes) and these total scores were used for analysis.[3] These repeated-measures ANOVAs were necessarily based only on those participants who endorsed experiencing *both* aversive and non-aversive memories, with *n*'s ranging from 15 to 17. There were several participants who endorsed experiencing *either* aversive or non-aversive memories (but not both) and who were excluded from the omnibus repeated-measures ANOVA despite having useable data; thus, to maximize power we conducted follow-up group contrasts for significant omnibus interactions using data for any participants who endorsed experiencing

---

[3]The interactive effects of Group and Memory Valence remained the same no matter whether coded internal and external details were analyzed in the recall condition alone or summed across levels of probing.

either aversive or non-aversive memories, with *n*'s ranging from 20 to 30.[4]

For hypothesis 2 analyses examining the impact of Group and Memory Valence on internal or external memory details, any significant omnibus effects of group were further probed with repeated-measures ANOVAs in which Group (SAD vs. HC) was the between-subjects factor and Detail Valence (positive, neutral, negative) was the within-subjects variable in order to unpackage whether differences in retrieved memory details depended on the valence of those details.

For all ANOVAs, significant interaction effects were followed-up with *t*-tests. Cohen's *d* effect sizes were calculated for all group contrasts, with established conventions for small, medium, and large effects corresponding with values of 0.2, 0.5, and 0.8, respectively (Cohen, 1988).

3.2 Missing data

Missing item-level data were imputed using the expectation-maximization (EM) method for each measure separately. When less than 5% of data are missing, a single imputation using EM improves power while providing unbiased parameter estimates (Enders, 2001; Scheffer, 2002). Overall, the percentage of missing data ranged from 0.04 to 1.4 percent across measures. Little's MCAR test was non-significant for 86% of measures administered. Data that were not missing completely at random based on Little's MCAR test were not imputed. Inability to recall an aversive/non-aversive memory was not conceptualized as missing data (see Results).

3.3 Data outliers and distributions

Data were screened for univariate and multivariate outliers (3 SDs from the mean). As any extreme values were within the plausible range, all data were retained. To ensure the

---

[4] The pattern of results of these follow-up contrasts in the larger sample remained unchanged when analyses were repeated with the smaller sample.

integrity of obtained findings, all *t*-tests and correlations were replicated with 95% bias-corrected

confidence-interval bootstrapping procedures in SPSS (Efron & Tibshirani, 1985; Preacher &

Hayes, 2004), which is robust to non-normally distributed data (Shrout & Bolger, 2002).

4. Results

4.1 Types of social situations endorsed by participants

The types of social events participants recollected included both social interaction

situations (e.g., going to parties, going on dates, meeting other people) and social performance

situations (e.g., giving class presentations or speeches, speaking up at a meeting or in class). It

was clear from reviewing the types of events retrieved that aversive and non-aversive memories

represented similar kinds of social situations that differed on the basis of whether their outcomes

were described as being either favourable or unfavourable. To this end, examples of aversive

events included "forgetting lines during a presentation," and "not getting the job at my first

group interview." Examples of non-aversive events included "performing positively at a group

lecture," and "completing my first job interview at a grocery store."

4.2 Equivalence of groups

There were no significant differences between SAD and HC participants in age, $t(78) =$

0.24, $p = .811$, gender distribution, $X^2(2) = 1.04$, $p = .593$, or ethnic/racial composition, $X^2(6) =$

5.33, $p = .503$. As expected, verbal scores on the SILS were equivalent across groups (SAD: $M =$

31.21, $SD = 4.51$; HC: $M = 30.37$, $SD = 4.59$), $t(79) = 0.835$, $p = .406$. The two groups differed

as expected across self-report symptom measures, with SAD participants reporting elevated

symptom levels relative to HCs both on the SPIN (SAD: $M = 45.75$, $SD = 8.22$; HC: $M = 15.45$,

$SD = 15.22$), $t(79) = 11.186$, $p < .001$, $d = 2.477$, and on the depression subscale of the DASS

(SAD: $M = 19.56$, $SD = 12.24$; HC: $M = 3.70$, $SD = 4.80$), $t(79) = 7.643$, $p < .001$, $d = 1.706$. The

remoteness of recollected events (in years) did not differ between groups for either aversive

events (SAD: $M = 10.65$, $SD = 12.24$; HC: $M = 10.10$, $SD = 14.06$), $t(54) = 0.156$, $p = .877$, $d =$

0.045, or non-aversive events (SAD: $M = 3.55$, $SD = 7.42$; HC: $M = 7.95$, $SD = 10.42$), $t(40) =$

1.563, $p = .126$, $d = 0.486$. Moreover, there was neither a significant main effect of Memory

Valence (aversive vs. non-aversive) nor a significant Group x Valence interaction effect on the

remoteness of reported memories (all F's < 3.164, all p's > .085).

4.3 Frequency of endorsed images and memories

As hypothesized, between-groups chi-square analyses demonstrated that HC and SAD

participants retrieved an equivalent proportion of aversive images and memories, and the same

was true of non-aversive images and memories (see Table 1). Additional chi-square tests to

explore potential group differences in the proportion of participants who endorsed only aversive

or non-aversive images, only aversive or non-aversive memories, both aversive and non-aversive

images or memories, and neither aversive or non-aversive images or memories were also non-

significant (all X^2 < 1.27, all p's > .204).

4.4 Coded internal and external memory details

Descriptive characteristics of coded memory details across groups are summarized in

Table 2. A 2 x 2 repeated-measures ANOVA examining the effects of Group (SADs: $n = 15$ vs.

HCs: $n = 16$) and Memory Valence (aversive vs. non-aversive memories) on total number of

retrieved internal details revealed a significant main effect of Group, $F(1, 29) = 4.821$, $p = .036$,

$\eta^2_p = .143$, with SAD participants retrieving a greater average number of internal details

collapsed across memory valences, but no significant main effect of Memory Valence, $F(1, 29) =$

2.299, $p = .140$, $\eta^2_p = .073$. These results were qualified by a significant Group x Memory

Valence interaction effect, $F(1, 29) = 4.583$, $p = .041$, $\eta^2_p = .136$. To decompose the significant

interaction effect, follow-up independent-samples t-tests for each type of memory separately revealed that for aversive memories, SAD participants ($M = 57.89$, $SD = 26.40$, $n = 27$) retrieved significantly more internal details than HCs ($M = 41.00$, $SD = 21.78$, $n = 29$), $t(54) = 2.619$, $p = .011$, $d = 0.698$. However, the number of retrieved internal details for non-aversive memories did not differ significantly between participants with SAD ($M = 53.00$, $SD = 24.76$, $n = 20$) and HCs ($M = 40.86$, $SD = 19.96$, $n = 21$), $t(39) = 1.733$, $p = .091$, $d = 0.540$. Paired-samples t-tests revealed that for participants with SAD, the number of internal details retrieved was greater for aversive memories ($M = 63.93$, $SD = 23.74$) than non-aversive memories ($M = 48.20$, $SD = 23.74$), $t(14) = 2.148$, $p = .050$. Conversely, among HC participants, there was no difference in the number of internal details for aversive memories ($M = 41.13$, $SD = 19.55$) versus non-aversive memories ($M = 43.81$, $SD = 19.75$), $t(15) = 0.569$, $p = .578$.

To follow up on these effects, a 2 x 3 repeated-measures ANOVA examining the effects of Group (SADs: $n = 27$ vs. HCs: $n = 29$) and Detail Valence (positive, neutral, negative) on total number of retrieved internal details for aversive memories revealed a significant main effect of Group, $F(1, 54) = 6.857$, $p = .011$, $\eta^2_p = .113$, as described above. There was also a significant main effect of Detail Valence, $F(2, 54) = 82.987$, $p < .001$, $\eta^2_p = .606$, with negative details reported more frequently than positive details ($p < .001$) and neutral details reported more frequently than either negative or positive details (p's $< .001$). These results were qualified by a significant Group x Detail Valence interaction effect, $F(2, 54) = 3.098$, $p = .049$, $\eta^2_p = .054$. Results of separate independent-samples t-tests conducted on each type of detail revealed that SAD participants differed from HCs only in their enhanced retrieval of negatively-valenced internal details when recalling aversive memories (SADs: $M = 22.15$, $SD = 10.29$; HCs: $M = 13.14$, $SD = 11.33$) $t(54) = 3.108$, $p = .003$, $d = 0.833$, but there were no group differences in the

number of retrieved neutral or positive details, $t(54)$'s < 1.754, p's > .085.

The repeated-measures ANOVA examining the effects of Group and Detail Valence on the number of retrieved external memory details revealed no significant main or interaction effects, all $F(1, 30)$'s < 1.515, all p's > .228, all η^2_p's < .050.

4.5 Memory appraisals

Descriptive characteristics of reported memory appraisals across groups are summarized in Table 2.

4.5.1 Memory vividness, memory intrusiveness, and influence of memory on self-perception

A 2 x 2 repeated-measures ANOVA examining the effects of Group (SADs: n = 15 vs. HCs: n = 17) and Memory Valence (aversive vs. non-aversive) on reported memory vividness revealed no significant main or interaction effects, all $F(1, 30)$'s < 1.859, all p's > .183, all η^2_p's < .058.

Similarly, for memory intrusiveness, the repeated-measures ANOVA revealed no significant main effects of Group or Memory Valence, F's (1, 30) < 0.435, p's > .515, η^2_p's < .014. However, these results were qualified by a significant Group x Memory Valence interaction effect, $F(1, 30) = 8.956$, $p = .005$, $\eta^2_p = .230$. Follow-up independent-samples t-tests for each type of memory separately revealed that SAD participants (M = 5.67, SD = 2.57, n = 27) reported that their aversive memories felt significantly more intrusive than those of HC participants (M = 3.17, SD = 2.14, n = 30), $t(55) = 4.007$, $p < .001$, $d = 1.057$. No difference was detected in the reported intrusiveness of non-aversive memories among participants with SAD (M = 4.00, SD = 2.47, n = 20) versus HCs (M = 3.91, SD = 2.60, n = 22), $t(40) = 0.116$, $p = .908$, $d = 0.035$. Paired-samples t-tests revealed that for participants with SAD, aversive memories were significantly more intrusive (M = 5.27, SD = 2.76) than non-aversive memories (M = 3.33,

$SD = 2.13$), $t(14) = 2.971$, $p = .010$. Conversely, among HC participants, no difference was detected in the intrusiveness of aversive memories ($M = 3.24$, $SD = 2.25$) versus non-aversive memories ($M = 4.47$, $SD = 2.67$), $t(16) = 1.522$, $p = .147$.

The repeated-measures ANOVA examining the effects of Group and Memory Valence on the degree to which the recollected events influenced participants' perceptions of themselves revealed a significant main effect of Group, $F(1, 30) = 4.767$, $p = .037$, $\eta^2_p = .137$, with SAD participants perceiving a greater average influence on self-perception collapsed across memory valences. There was also a significant main effect of Memory Valence, $F(1, 30) = 18.547$, $p < .001$, $\eta^2_p = .382$, with a greater average influence on self-perception attributed to aversive memories than non-aversive ones collapsed across groups. These results were qualified by a significant Group x Memory Valence interaction effect, $F(1, 30) = 15.907$, $p < .001$, $\eta^2_p = .347$. Follow-up independent-samples t-tests for each type of memory separately revealed that for aversive memories, SAD participants ($M = 6.63$, $SD = 2.26$, $n = 27$) reported a significantly greater influence on self-perception than HC participants ($M = 3.57$, $SD = 1.74$, $n = 30$), $t(55) = 5.778$, $p < .001$, $d = 1.517$. However, no difference was detected in the reported effects of non-aversive memories on self-perception among participants with SAD ($M = 4.35$, $SD = 2.13$, $n = 20$) versus HCs ($M = 4.36$, $SD = 2.65$, $n = 22$), $t(40) = 0.018$, $p = .986$, $d = 0.004$. Paired-samples t-tests revealed that for participants with SAD, aversive memories were rated as being significantly more influential of self-perception ($M = 7.07$, $SD = 2.02$) than non-aversive memories ($M = 4.00$, $SD = 2.10$), $t(14) = 5.890$, $p < .001$. Conversely, among HC participants, no difference was detected in the influence of aversive memories ($M = 4.18$, $SD = 1.78$) versus non-aversive memories ($M = 4.06$, $SD = 2.46$) on self-perception, $t(16) = 0.226$, $p = .824$. These effects are shown in Figure 1.

4.5.2 Impact of memory retrieval on positive and negative affect

A 2 x 2 repeated-measures ANOVA examining the effects of Group (SADs: $n = 15$ vs. HCs: $n = 17$) and Memory Valence (aversive vs. non-aversive) on reported PANAS positive affect revealed a significant main effect of Group, $F(1, 30) = 9.491$, $p = .004$, $\eta^2_p = .240$, with SAD participants reporting significantly lower levels of positive affect during memory retrieval on average. There was also a significant main effect of Memory Valence, $F(1, 30) = 22.699$, $p < .001$, $\eta^2_p = .431$, with aversive memories generating significantly less positive affect than non-aversive memories when collapsed across groups. The Group x Memory Valence interaction effect was not significant, $F(1, 30) = 0.026$, $p = .873$, $\eta^2_p = .001$, suggesting that the magnitude of the observed difference in positive affect between groups was not moderated by the valence of the memories retrieved.

The 2 x 2 repeated-measures ANOVA examining the effects of Group and Memory Valence on reported PANAS negative affect revealed no significant main effect of Group, $F(1, 30) = 1.582$, $p = .218$, $\eta^2_p = .050$. There was, however, a significant main effect of Memory Valence, $F(1, 30) = 38.257$, $p < .001$, $\eta^2_p = .560$, with aversive memories generating significantly more negative affect, on average, than non-aversive memories, when collapsed across groups. The Group x Memory Valence interaction effect was also significant, $F(1, 30) = 5.530$, $p = .025$, $\eta^2_p = .156$. Follow-up independent-samples *t*-tests for each type of memory separately revealed that during retrieval of aversive memories, SAD participants ($M = 48.31$, $SD = 17.25$, $n = 27$) experienced significantly higher levels of negative affect than HC participants ($M = 30.38$, $SD = 18.82$, $n = 30$), $t(55) = 3.734$, $p < .001$, $d = 0.993$. However, no difference was detected in the reported effects of non-aversive memory retrieval on negative affect for participants with SAD ($M = 14.70$, $SD = 5.23$, $n = 20$) versus HCs ($M = 17.01$, $SD = 13.09$, $n = $

22), $t(40) = 0.737$, $p = .466$, $d = 0.232$. Paired-samples t-tests revealed that for participants with

SAD, aversive memory retrieval activated significantly more negative affect ($M = 44.15$, $SD =$

16.88) than non-aversive memory retrieval ($M = 13.60$, $SD = 4.85$), $t(14) = 7.199$, $p < .001$.

Similarly, HC participants reported experiencing significantly more negative affect during

aversive memory retrieval ($M = 30.73$, $SD = 19.28$) than during retrieval of non-aversive

memories ($M = 17.01$, $SD = 14.63$), $t(16) = 2.459$, $p = .026$.

Discussion

This study was designed to enhance our understanding of the phenomenological

characteristics of autobiographical memories in SAD. As hypothesized, participants' capacity to

access and retrieve specific autobiographical memories was not moderated by diagnostic status

or valence. That is, irrespective of their valence, both mental images and their associated specific

autobiographical memories were readily accessible for both individuals with SAD and non-

anxious controls – findings that are consistent with those observed previously in undergraduates

with high versus low levels of trait social anxiety (Moscovitch et al., 2011). Together, results

from these two studies indicate that negative images and autobiographical memories of socially

painful events are commonly experienced not only by highly anxious individuals or by those

with SAD, but by people across the entire social anxiety spectrum.

It is important to note that WIMI interviewers in the current study were trained to accept

autobiographical memories that were endorsed by participants only if those memories were

"specific" according to the way *specificity* is commonly defined on the AMT (i.e., as referencing

a specific event that occurred at a particular time and place; Williams et al., 2007). Thus, any

"yes" response for memory endorsement rates (see Table 1) represented a "specific" memory as

per the AMT definition of the term, whereas any "no" response included any "non-specific" or

"overgeneral" memories that participants may have retrieved. In this way, the absence of group differences in the retrieval of specific autobiographical memories in the present study is also consistent with results of previous AMT studies that have shown no differences in retrieval rates of overgeneral vs. specific memories in patients with SAD vs. controls (e.g., Heidenreich, Junghanns-Royack, & Stangier, 2007; Wenzel, Jackson, & Holt, 2002).

Approximately 15% of participants with SAD did not report having intrusive aversive images, and about one-third had no autobiographical memories of aversive social events even if they reported experiencing aversive images. A simple explanation for these findings is that non-endorsement of mental imagery might reflect individual differences in participants' abilities to think visually and use imagery, as previous studies of individuals with SAD have shown (McEvoy, Erceg-Hurn, Saulsman, & Thibodeau, 2015). Similarly, non-responses to probes about specific memories might simply represent recall failures. Alternatively, some participants may have been reluctant to open up and share aversive experiences due to feelings of shame about revealing humiliating memories of perceived social failures to interviewers. However, our experience during data collection was that most participants were very forthcoming and that the majority of participants did, in fact, reveal such failures, despite reporting elevated negative affect, including shame, when such memories were retrieved. Reported memories were also rated as being highly self-relevant, suggesting that participants were retrieving important experiences. Future research could examine whether these results would replicate if participants are instructed to provide written descriptions of their memories, in which social desirability concerns may be even less salient. Future research might also explore subtypes of images (e.g., those that are more realistic/concrete versus those that reflect abstract/symbolic or dreamlike elements). It is possible, for example, that realistic/concrete images may be more likely to be associated with

retrieving a corresponding autobiographical memory, while abstract/symbolic images may be more difficult for participants to connect with autobiographical experiences or more likely to represent schema-based information that is not derived from a specific autobiographical memory.

Even though many participants with SAD endorsed having specific negative autobiographical memories of socially painful events, we must be careful about concluding that the mere occurrence of an aversive experience in and of itself might be a causal factor in the etiology of SAD, as HCs generally reported having memories of such experiences as well. Rather, a variety of factors might affect how such events – and corresponding memories of such events – are appraised, and it is these appraisals that might principally distinguish people who have SAD or are likely to develop SAD from those who do not. Indeed, participants with SAD appraised the characteristics of socially adverse event memories more negatively than HCs, rating them as being significantly more intrusive, as having a greater impact on their self-perception, and as fueling significantly higher levels of negative affect during retrieval. People's appraisals of salient self-defining events and memories could certainly play an important role in the development of particular beliefs they hold about themselves or others and/or strengthen existing negative beliefs that fuel the persistence of anxiety symptoms (Romano et al., in press).

Our methods in the present study were intentionally designed to allow for an examination of episodic recollection that moves beyond the AMT's distinction between specific and overgeneral memories as the level of analysis. Here, we analyzed the details of the retrieved memory narratives themselves with the use of the innovative coding system drawn from the Autobiographical Interview (AI), as described in the Introduction. Although there were no group differences in retrieval rates of specific aversive or non-aversive memories, we found that participants with SAD did indeed differ from HCs in the *types of details* they recalled within

their specific memories, such that they tended to retrieve more internal details (and, in particular, negatively-valenced internal details) than HCs for memories of aversive, but not non-aversive, social events. Given that internal details are, by definition, retrieved by traveling back through time within one's imagination to relive a particular episode that occurred at a specific time and place in one's personal past, these findings support the potential importance of *mental time travel* in the phenomenology of biased episodic memory recall in social anxiety. Interestingly, mental time travel to both recollected pasts and imagined futures are subserved by similar cognitive and neurobiological systems (see Addis & Schacter, 2008), suggesting that episodic memory processes may represent a crucial link between pre-event anxious anticipation and post-event processing (PEP) in social anxiety; however, extant research on this topic is limited and findings are mixed (see Mellings & Alden, 2000; Modini, Rapee, & Abbott, 2018). In future studies, use of the WIMI and AI methodology may be helpful for tracking the retrieval of particular memory details across time.

Further investigation of PEP in SAD may also help to provide clues about *why* people with SAD might recollect negative social experiences in such rich episodic detail. It is possible that episodic enhancement may occur, at least in part, during event encoding such that anxious individuals attend to and process negative aspects of the event in greater detail as the event itself unfolds. Alternatively (and possibly in tandem with enhanced encoding), memories of aversive social events may be processed in more detail and embellished over time through the effects of repeated rehearsal via PEP, likely in interaction with interpretation biases (e.g., Hertel, Brozovich, Joormann, & Gotlib, 2008). As stated above, in PEP, socially anxious individuals "play back" and ruminate about negative social experiences (see Gavric, Moscovitch, Rowa, & McCabe, 2017). Past studies have shown that there are constructive and unconstructive forms of

rumination, with evidence supporting the view that analytical rumination focused on self-evaluation and abstract meanings may fuel overgeneral memories and associated maladaptive outcomes, particularly for people who are depressed (Watkins, 2008). In the present study, however, the specific memories that were retrieved by participants with SAD contained ample sensory-perceptual detail and hardly resembled the types of sensory-detail-deficient overgeneral memories that have been described in the depression literature (Williams et al., 2007). It is possible that heightened negative affect during recall of specific aversive autobiographical memories in SAD activates the processing of "local" threat-relevant sensory/perceptual detail rather than "global" or big picture detail that is generally favoured by the cognitive system (Gasper & Clore, 2002), thereby facilitating episodic enhancement for local details. This tentative hypotheses could be tested in future well-designed experimental studies.

With repeated rehearsal over time as individuals with SAD engage in PEP, aversive memories may become even more highly accessible and detailed through the processes of memory reconstruction, embellishment, and enhancement (Moscovitch, 2008; Schacter, 2012). Though studies on undergraduate participants have found mixed support for the hypothesis that PEP mediates the relation between social anxiety and biased recall of social information (Cody & Teachman, 2010; Edwards, Rapee, & Franklin, 2003), a recent study demonstrated that undergraduate students with higher levels of social anxiety accurately recalled negative and positive feedback they received about a social task in the immediate aftermath of the task, but their recall of positive information became more negatively biased as time went on (Glazier & Alden, 2017). However, this study was not conducted on a clinical sample of individuals with SAD, nor was PEP explicitly measured as an underlying mechanism that may have accounted for this retrieval bias. In another recent study on clinical participants with SAD, Gavric et al. (2017)

demonstrated that the relationship between social anxiety and PEP in the week following an

anxiety-provoking social task was mediated both by the extent to which participants negatively

evaluated their performance on the task and the extent to which they held positive metacognitive

beliefs about engaging in PEP. Individuals with SAD may believe that engaging in repeated

mental review in the aftermath of such experiences is adaptive for their social survival, given

their perceived tenuous standing within the social hierarchy and their assumption that

committing a social blunder has the potential to put them at serious risk of ostracism or exclusion

from the social group (Moscovitch, Waechter, Bielak, Rowa, & McCabe, 2015; Rodebaugh,

2009; Weeks, Rodebaugh, Heimberg, Norton, & Jakatdar, 2009). Future prospective studies

could investigate whether PEP mediates the retrieval of internal details for memories of aversive

social experiences.

　　　　With respect to clinical implications, results highlight the potential benefits of imagery-

and memory-based interventions for SAD that facilitate emotional expression (Holmes &

Mathews, 2010) and enhance CBT outcomes (McEvoy et al., 2015; Stopa, 2009). Among such

interventions, Imaginal Rescripting (IR) is uniquely designed to target and modify negative

autobiographical memory content and appraisal. Though the specific cognitive mechanisms of IR

remain poorly understood, studies have found that IR promotes significant improvements in

symptoms and core beliefs for patients with SAD after only a single-session administration (see

Norton & Abbott, 2016; Reimer & Moscovitch, 2015; Wild & Clark, 2011). Future research on

imagery- and memory-based interventions and processes, including IR, would provide an ideal

context for examining how socially aversive experiences are encoded, consolidated, and stored in

memory (e.g., Çili & Stopa, 2015; Conway & Pleydell-Pearce, 2000; Prebble, Addis, & Tippett,

2013). Incorporating the WIMI and AI coding scheme into such studies could help researchers

elucidate the conditions under which positive versus negative autobiographical memory representations – and the internal and external details that comprise them - may become emotionally activated, retrieved, and psychotherapeutically modified within specific contexts (see Lane et al., 2015). Well-designed studies that use the WIMI to elicit and *directly measure* (rather than simply infer) changes in negative and positive imagery- and memory-based mental representations before and after treatment could help enable researchers test competing theories about the precise cognitive mechanisms that underlie the effectiveness of CBT, including emotional processing (Foa & McNally, 1996), competition retrieval (Brewin, 2006), inhibitory learning (Craske et al., 2008), and memory reconsolidation (Ecker, 2015) (see also Moscovitch, Antony, & Swinson, 2009).

Though the current study had several strengths, including a community based sample of clinically diagnosed and control participants, a combination of subjectively reported and blind-coded outcomes, and comparisons of aversive and non-aversive memories, it was also limited by several factors, which future studies may help to address. First, while results supported the negative memory enhancement hypothesis, they did not support the "positivity deficit" hypothesis, in-so-far as there was no evidence that memories of non-aversive social events were less accessible for individuals with SAD than HCs and, when accessed, were retrieved with degraded detail or appraised in a less positive manner. However, it is possible that positivity deficits would emerge for participants with SAD if they were instructed to retrieve memories that were more strongly or objectively positive, such as those representing obvious interpersonal achievements or social milestones that were associated with significantly enhanced feelings of social pride, acceptance, or inclusion, and this hypothesis should be re-examined under these conditions in future studies. If even more positive memories could, in fact, be recollected, it

would be of interest to examine their retrieval and appraisal properties in comparison to memories of aversive social failures or experiences about which participants felt inherently ashamed or excluded (see LaBar & Cabeza, 2006). In a similar vein, future research must also investigate whether episodic enhancements in SAD are unique to socially painful experiences or might also extend to memories of aversive non-social events.

Furthermore, as with most studies on autobiographical memory, it was impossible to ascertain whether enhancement of episodic memory details was due to (a) remembering more veridical information about the events or (b) unintentionally embellishing memory details with non-factual information. Future studies could assess memory for standardized stimuli and use creative methods for disentangling these two factors (e.g., Hertel et al., 2008), but the use of such stimuli would inherently hinder the generalizability of conclusions to real-life autobiographical memories. Indeed, even assessing memory for a standardized social blunder elicited in the laboratory would be methodologically limited in so far as participants could never be compelled to appraise such contrived experiences as being socially costly or self-defining, which may be important factors that fuel the episodic enhancement of autobiographical memories for aversive events within naturalistic social contexts.

In addition, even though the present study represents a necessary initial step in which WIMI and AI outcomes were examined for the first time in a clinical sample of participants with SAD, the interpretations of our findings are necessarily limited by the absence of a psychopathology control group, which would have allowed for more definitive conclusions about whether the observed effects were unique and specific to social anxiety per se. Such specificity may be expected, given the socially threatening nature of the aversive memories that were probed in this study, but an ideal future study would investigate the retrieval and appraisal of

both social and non-social memories in a group of participants with SAD and no significant

comorbid symptoms of depression as well as a group of individuals with depression and no

secondary symptoms of social anxiety. Though a study of this nature would be desirable, a

significant challenge facing researchers would be that symptoms of depression and SAD tend to

be intricately intertwined and highly comorbid with one another (e.g., Moscovitch et al., 2005).

Thus, any conclusions drawn from such a study would have to be tempered by appropriate

caveats about external validity and the extent to which findings would be generalizable to the

commonly overlapping presentation of these disorders in nature (Ohayon & Schatzberg, 2010).

Finally, results of the present study do not directly highlight the real-life implications of

episodic enhancement in SAD. Even if socially anxious individuals exhibit enhanced episodic

memory for aversive past personal events, how might this impact their day-to-day lives? Future

research is needed to understand how negative memory enhancement in SAD might affect

outcomes that ought to be closely related to, and perhaps even dependent on, episodic memory,

including social problem solving and prospection (Goddard, Dritschel, & Burton, 1996; Madore

& Schacter, 2016).

Despite these limitations and caveats, the present study was the first to characterize the

mnemonic architecture of aversive relative to non-aversive social experiences in SAD. Though

conclusions must be tempered by the need for additional research to replicate and extend our

initial findings, results are interesting and cast new light on autobiographical memory bias in

social anxiety in ways that may help to guide new research and clinical application.

Acknowledgements

References

Addis, D. R., & Schacter, D. L. (2008). Constructive episodic simulation: Temporal distance and detail of past and future events modulate hippocampal engagement. *Hippocampus*, *18*, 227-237.

Alden, L. E., & Taylor, C. T. (2004). Interpersonal processes in social phobia. *Clinical Psychology Review*, *24*, 857-882.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Association.

Antony, M. M., Bieling, P. J., Cox, B. J., Enns, M. W., & Swinson, R. P. (1998). Psychometric properties of the 42-item and 21-item versions of the Depression Anxiety Stress Scales in clinical groups and a community sample. *Psychological Assessment*, *10*, 176-181.

Antony, M. M., Coons, M. J., McCabe, R. E., Ashbaugh, A., & Swinson, R. P. (2006). Psychometric properties of the social phobia inventory: Further evaluation. *Behaviour Research and Therapy*, *44*, 1177-1185.

Brewin, C. R. (2006). Understanding cognitive behaviour therapy: A retrieval competition account. *Behaviour Research and Therapy*, *44*, 765-784.

Brown, T. A., & Barlow, D. H. (2014). *Anxiety disorders interview schedule for DSM-5: Clinical interview schedule*. Oxford, UK: Oxford University Press.

Brown, T. A., DiNardo, P., & Barlow, D. H. (1994). *Anxiety disorders interview schedule for DSM-IV: Client interview schedule*. Oxford, UK: Oxford University Press.

Carleton, R. N., Peluso, D. L., Collimore, K. C., & Asmundson, G. J. (2011). Social anxiety and posttraumatic stress symptoms: The impact of distressing social events. *Journal of Anxiety Disorders*, *25*, 49-57.

Chiupka, C. A., Moscovitch, D. A., & Bielak, T. (2012). In-vivo activation of anticipatory vs. post-event autobiographical images and memories in social anxiety. *Journal of Social and Clinical Psychology, 31,* 783-809.

Çili, S., & Stopa, L. (2015). The retrieval of self-defining memories is associated with the activation of specific working selves. *Memory*, *23*, 233-253.

Clark, D. M., & Wells, A. (1995). A cognitive model of social phobia. In R. G. Heimberg, M. R. Liebowitz, D. A. Hope, & F. R. Schneier (Eds.), *Social phobia: Diagnosis, assessment and treatment* (pp. 69-93). New York, NY: Guilford.

Cody, M. W., & Teachman, B. A. (2010). Post-event processing and memory bias for performance feedback in social anxiety. *Journal of Anxiety Disorders, 24,* 468-479.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences. London, UK:* Routledge.

Connor, K. M., Davidson, J. R. T., Churchill, L. E., Sherwood, A., Foa, E., &Weisler, R. H. (2000). Psychometric properties of the Social Phobia Inventory (SPIN): New self-rating scale. *British Journal of Psychiatry*, *176*, 379-386.

Conway, M. A., & Pleydell-Pearce, C. W. (2000). The construction of autobiographical memories in the self-memory system. *Psychological Review*, *107*, 261-288.

Craske, M. G., Kircanski, K., Zelikowsky, M., Mystkowski, J., Chowdhury, N., & Baker, A. (2008). Optimizing inhibitory learning during exposure therapy. *Behaviour Research and Therapy*, *46*, 5-27.

Dalgleish, T., Williams, J. M., Golden, A. M., Perkins, N., Barrett, L. F., & Barnard, P. J. (2007). Reduced specificity of autobiographical memory and depression: The role of executive control. *Journal of Experimental Psychology: General*, *136*, 23–42.

Ecker, B. (2015). Memory reconsolidation understood and misunderstood. *International Journal of Neuropsychothearpy, 3,* 2-46.

Edwards, S. L., Rapee, R. M., Franklin, J. (2003). Postevent rumination and recall bias for a social performance event in high and low socially anxious individuals. *Cognitive Therapy and Research, 27,* 603-617.

Efron, B., & Tibshirani, R. (1985). The bootstrap method for assessing statistical accuracy. *Behaviormetrika*, *17*, 1-35.

Enders, C. K. (2001). The performance of the full information maximum likelihood estimator in multiple regression models with missing data. *Educational and Psychological Measurement*, *61*, 713-740.

Erwin, B. A., Heimberg, R. G., Marx, B. P., & Franklin, M. E. (2006). Traumatic and socially stressful life events among persons with social anxiety disorder. *Anxiety Disorders*, *20*, 896-914.

Foa, E. B., & McNally, R. J. (1996). Mechanisms of change in exposure therapy. In R. M. Rapee (Ed.), *Current controversies in anxiety disorders* (pp. 329-343). New York, NY: The Guilford Press.

Gasper, K., & Clore, G. L. (2002). Attending to the big picture: Mood and global versus local processing of visual information. *Psychological Science, 13,* 34–40.

Gavric, D., Moscovitch, D. A., Rowa, K., & McCabe, R. E. (2017). Post-event processing in social anxiety disorder: Examining the mediating roles of positive metacognitive beliefs and perceptions of performance. *Behaviour Research and Therapy*, *91*, 1-12.

Glazier, B. L., & Alden, L. E. (2017). Social Anxiety and Biased Recall of Positive Information: It's Not the Content, It's the Valence. *Behavior Therapy*, *48*, 533-543.

Goddard, L., Dritschel, B., & Burton, A. (1996). Role of autobiographical memory in social

    problem solving and depression. *Journal of Abnormal Psychology*, *105*, 609-616.

Griffith, J. W., Sumner, J. A., Raes, F., Barnhofer, T., Debeer, E., & Hermans, D. (2012).

    Current psychometric and methodological issues in the measurement of overgeneral

    autobiographical memory. *Journal of Behavior Therapy and Experimental Psychiatry, 43*

    (Suppl. 1), S21-S31.

Hackmann, A., & Holmes, E. A. (2004). Reflecting on imagery: A clinical perspective and

    overview of the special issue of memory on mental imagery and memory in

    psychopathology. *Memory*, *12*, 389-402.

Hackmann, A., Clark, D. M., & McManus, F. (2000). Recurrent images and early memories in

    social phobia. *Behaviour Research and Therapy*, *38*, 601-610.

Hackmann, A., Surawy, C., & Clark, D. M. (1998). Seeing yourself through others' eyes: A

    study of spontaneously occurring images in social phobia. *Behavioral and Cognitive*

    Psychotherapy, *26*, 3-12.

Hayes, A. F., & Preacher, K. J. (2014). Statistical mediation analysis with a multicategorical

    independent variable. *British Journal of Mathematical and Statistical Psychology*, *67*,

    451-470.

Heidenreich, T., Junghanns-Royack, K., & Stangier, U. (2007).Specificity of autobiographical

    memory in social phobia and major depression. *British Journal of Clinical Psychology,*

    46, 19-33.

Hertel., P. T., Brozovich, F., Joormann, J., & Gotlib, I. H. (2008). Biases in interpretation and

    memory in generalized social phobia. *Journal of Abnormal Psychology, 117,* 278-288.

Hirsch, C. R., Clark, D. M., & Mathews, A. (2006). Imagery and interpretations in social phobia:

Support for the combined cognitive biases hypothesis. *Behavior Therapy*, *37*(3), 223-236.

Hirsch, C. R., Clark, D. M., Mathews, A., & Williams, R. (2003). Self-images play a causal role in social phobia. *Behaviour Research and Therapy*, *41*, 909-921.

Holmes, E. A., & Mathews, A. (2010). Mental imagery in emotion and emotional disorders. *Clinical Psychology Review*, *30*, 349-362.

Kashdan, T. B., Weeks, J. W., & Savostyanova, A. A. (2011). Whether, how, and when social anxiety shapes positive experiences and events: A self-regulatory framework and treatment implications. *Clinical Psychology Review*, *31*, 786-799.

Koban, L., Schneider, R., Ashar, Y. K., Andrews-Hanna, J. R., Landy, L., Moscovitch, D. A., Wager, T. D., & Arch, J. J. (2017). Social anxiety is characterized by biased learning about performance and the self. *Emotion, 17,* 1144-1155.

Krans, J., de Bree, J., & Bryant, R. A. (2014). Autobiographical memory bias in social anxiety. *Memory*, *22*, 890-897.

Krans, J., Peeters, M., Näring, G., Brown, A. D., de Bree, J., & Van Minnen, A. (2017). Examining temporal alterations in Social Anxiety Disorder and Posttraumatic Stress Disorder: The relation between autobiographical memory, future goals, and current self-views. *Journal of Anxiety Disorders*, *52*, 34-42.LaBar, K. S., & Cabeza, R. (2006). Cognitive neuroscience of emotional memory. *Nature Reviews Neuroscience, 7,* 54-64.

Lane, R. D., Ryan, L., Nadel, L., & Greenberg, L. (2015). Memory reconsolidation, emotional arousal, and the process of change in psychotherapy: New insights from brain science. *Behavioral and Brain Sciences*, *38*, 1-64.

Lee, S. W., & Kwon, J. H. (2013). The efficacy of imagery rescripting (IR) for social phobia: A randomized controlled trial. *Journal of Behavior Therapy and Experimental*

Psychiatry, *44*, 351-360.

Levine, B., Svoboda, E., Hay, J. F., Winocur, G., & Moscovitch, M. (2002). Aging and

autobiographical memory: Dissociating episodic from semantic retrieval. *Psychology and*

Aging, *17*, 677-689.

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states:

Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression

and Anxiety Inventories. *Behaviour Research and Therapy*, *33*, 335-342.

Madore, K. P., & Schacter, D. L. (2016). Remembering the past and imagining the future:

Selective effects of an episodic specificity induction on detail generation. *Quarterly*

Journal of Experimental Psychology, *69*, 285-298.

McEvoy, P. M., Erceg-Hurn, D. M., Saulsman, L. M., & Thibodeau, M. A. (2015). Imagery

enhancements increase the effectiveness of cognitive behavioural group therapy for social

anxiety disorder: A benchmarking study. *Behaviour Research and Therapy*, *65*, 42-51.

McGaugh, J. L. (2003). *Memory and emotion: The making of lasting memories. Maps of the*

mind. New York, NY: Columbia University Press.

McKinnon, M. C., Palombo, D. J., Nazarov, A., Kumar, N., Khuu, W., & Levine, B. (2015).

Threat of death and autobiographical memory: A study of passengers from Flight

AT236. *Clinical Psychological Science*, *3*, 487-502.

McManus, F., Clark, D. M., & Hackmann, A. (2000). Specificity of cognitive biases in social

phobia and their role in recovery. *Behavioural and Cognitive Psychotherapy*, *28*, 201-

209.

Mellings, T. M. B., & Alden, L. E. (2000). Cognitive processes in social anxiety: the effects of

self-focus, rumination, and anticipatory processing. *Behaviour Research and Therapy*,

38, 243-257.

Miller, G. A., & Chapman, J. P. (2001). Misunderstanding analysis of covariance. *Journal of abnormal psychology*, *110*(1), 40.

Modini, M., Rapee, R. M., & Abbott, M. J. (2018). Processes and pathways mediating the experience of social anxiety and negative rumination. *Behaviour Research and Therapy, 103,* 24-32.

Morgan, J. (2010). Autobiographical memory biases in social anxiety. *Clinical Psychology Review*, *30*, 288-297.

Moscovitch, M. (2008). The hippocampus as a "stupid," domain-specific module: Implications for theories of recent and remote memory, and of imagination. *Canadian Journal of Experimental Psychology*, *62*, 62-79.

Moscovitch, D. A. (2009). What is the core fear in social phobia? A new model to facilitate individualized case conceptualization and treatment. *Cognitive and Behavioral Practice*, *16*, 123-134.

Moscovitch, D. A. (2016). Early memories in social anxiety: A meaningful and enduring collaboration with my Dad. *Neuropsychologia, 90,* 286-292.

Moscovitch, D. A., Antony, M. M., & Swinson, R. P. (2009). Exposure-based treatments for anxiety disorders: Theory and process. In M. M. Antony, & M. B. Stein (Eds.), *Oxford handbook of anxiety and related disorders* (pp. 461-475). New York, NY: Oxford University Press.

Moscovitch, D. A., Chiupka, C. A., & Gavric, D. L. (2013). Within the mind's eye: Negative mental imagery activates different emotion regulation strategies in high versus low socially anxious individuals. *Journal of Behavior Therapy and Experimental Psychiatry*,

44(4), 426-432.

Moscovitch, D. A., Gavric, D. L., Merrifield, C., Bielak, T., & Moscovitch, M. (2011). Retrieval properties of negative vs. positive mental images and autobiographical memories in social anxiety: Outcomes with a new measure. *Behaviour Research and Therapy*, *49*(8), 505-517.

Moscovitch, D. A., Hofmann, S. G., Suvak, M. K., & In-Albon, T. (2005). Mediation of changes in anxiety and depression during treatment of social phobia. *Journal of Consulting and Clinical Psychology*, *73*, 945-952.

Moscovitch, D. A., & Huyder, V. (2011). The negative self-portrayal scale: Development, validation, and application to social anxiety. *Behavior Therapy*, *42*, 183-196.

Moscovitch, D. A., Rowa, K., Paulitzki, J. R., Antony, M. M., & McCabe, R. E. (2015). What if I appear boring, anxious, or unattractive? Validation and treatment sensitivity of the negative self-portrayal scale in clinical samples. *Cognitive Therapy and Research*, *39*, 178-192.

Moscovitch, D. A., Rowa, K., Paulitzki, J. R., lerullo, M. D., Chiang, B., Antony, M. M., & McCabe, R. E. (2013). Self-portrayal concerns and their relation to safety behaviors and negative affect in social anxiety disorder. *Behavior Research and Therapy*, *51*(8), 476-486.

Moscovitch, D. A., Waechter, S., Bielak, T., Rowa, K., & McCabe, R. E. (2015). Out of the shadows and into the spotlight: Social blunders fuel fear of self-exposure in social anxiety disorder. *Journal of Anxiety Disorders, 34,* 24-32

Norton, A. R., & Abbott, M. J. (2016). The efficacy of imagery rescripting compared to cognitive restructuring for social anxiety disorder. *Journal of Anxiety Disorders*, *40*, 18-

28.

Ohayon, M. M., & Schatzberg, A. F. (2010). Social phobia and depression: prevalence and comorbidity. *Journal of Psychosomatic Research*, *68*, 235-243.

O'Toole, M. S., Watson, L. A., Rosenberg, N. K., & Berntsen, D. (2016). Negative autobiographical memories in social anxiety disorder: A comparison with panic disorder and healthy controls. *Journal of Behavior Therapy and Experimental Psychiatry*, *50*, 223-230.

Pinninti, N. R., Madison, H., Musser, E., & Rissmiller, D. (2003). MINI International Neuropsychiatric Schedule: Clinical utility and patient acceptance. *European Psychiatry*, *18*, 361-364.

Plasencia, M. L., Alden, L. E., & Taylor, C. T. (2011). Differential effects of safety behaviour subtypes in social anxiety disorder. *Behaviour Research and Therapy*, *49*, 665-675.

Plasencia, M. L., Taylor, C. T., & Alden, L. E. (2016). Unmasking one's true self facilitates positive relational outcomes: Authenticity promotes social approach processes in social anxiety disorder. *Clinical Psychological Science*, *4*, 1002-1014.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers*, *36*, 717-731.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, *40*, 879-891.

Prebble, S. C., Addis, D. R., & Tippett, L. J. (2013). Autobiographical memory and sense of self. *Psychological Bulletin*, *139*, 815-840.

Rapee, R. N., & Heimberg, R. G. (1997). A cognitive-behavioral model of anxiety in social

phobia. *Behaviour Research and Therapy*, *35*, 741-756.

Reimer, S., & Moscovitch, D. (2015). The impact of imagery rescripting on memory appraisals

and core beliefs in social anxiety disorder. *Behaviour Research and Therapy*, *75*, 48–59.

Rodebaugh, T. L. (2009). Hiding the self and social anxiety: The core extrusion schema

measure. *Cognitive Therapy and Research*, *33*, 90-109.

Romano, M., Ma, R., Moscovitch, M., & Moscovitch, D. A. (in press). Autobiographical

memory bias. In J.S. Abramowitz & S.M. Blakey (Eds.), *Clinical handbook of fear and

anxiety: Psychological processes and treatment mechanisms*. Washington, DC: American

Psychological Association Press.

Rowa, K., Paulitzki, J. R., Ierullo, M. D., Chiang, B., Antony, M. M., McCabe, R. E., et al.

(2015). A false sense of security: Safety behaviors erode objective speech performance in

individuals with social anxiety disorder. *Behaviour Therapy*, *46*, 304-314.

Schacter, D. L. (2012). Adaptive constructive processes and the future of memory. *American

Psychologist*, *67*, 603-613.

Scheffer, J. (2002). Dealing with missing data. *Research Letters in the Information and

Mathematical Sciences*, *3*, 153-160.

Sheehan. D. V. (2014). *The Mini-International Neuropsychiatric Interview, Version 7.0 for

DSM-5 (M.I.N.I 7.0)*. Jacksonville, FL: Medical Outcomes Systems.

Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Amorim, P., Janavs, J., Weiller, E., et al. (1998).

The Mini-International Neuropsychiatric Interview (M.I.N.I.): The development and

validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10.

Journal of Clinical Psychiatry, *59*(Suppl. 20), 22-33.

Shipley, W. C. (1940). A self-administering scale for measuring intellectual impairment and

deterioration. *Journal of Psychology: Interdisciplinary and Applied*, *9*, 371-377.

Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New

procedures and recommendations. *Psychological Methods*, *7*, 422-445.

Söderlund, H., Moscovitch, M., Kumar, N., Daskalakis, J., Flint, A., Herrmann, N., & Levine, B.

(2014). Autobiographical episodic memory in major depressive disorder. *Journal of

Abnormal Psychology*, *123*, 51–60.

Stein, M. B., & Stein, D. J. (2008). Social anxiety disorder. *The Lancet*, *371*, 1115-1125.

Stopa, L. (2009). Why is the self important in understanding and treating social phobia?

Cognitive Behavior Therapy, *38*, 48-54.

Stopa, L. (2009). *Imagery and the threatened self: Perspectives on mental imagery and the self

in cognitive therapy*. New York, NY: Routledge.

Tulving, E. (1972). Episodic and semantic memory. In E. Tulving, & W. Donaldson (Eds.),

Organisation of memory (pp. 381-403). London, UK: Academic Press.\

Tulving, E. (1985). Memory and consciousness. *Canadian Psychology, 26,* 1–12.

Tulving, E. (1989). Remembering and knowing the past. *American Scientist, 77,* 361–367.

Watkins, E. (2008). Constructive and unconstructive repetitive thought. *Psychological Bulletin,

134,* 163-206.

Watkins, E., & Teasdale, J. D. (2001). Rumination and overgeneral memory in depression:

Effects of self-focus and analytic thinking. *Journal of Abnormal Psychology, 110,* 353-

357.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures

of positive and negative affect: The PANAS scales. *Journal of Personality and Social*

Psychology, *54*, 1063-1070.

Weeks, J. W. (2014). *The Wiley-Blackwell handbook of social anxiety disorder*. West Sussex, UK: John Wiley & Sons, Ltd.

Wenzel, A., Jackson, L. C., Holt, C. S. (2002). Social phobia and the recall of autobiographical memories. *Depression and Anxiety, 15,* 186-189.

Weeks, J. W., Rodebaugh, T. L., Heimberg, R. G., Norton, P. J., & Jakatdar, T. A. (2009). "To avoid evaluation, withdraw": Fears of evaluation and depressive cognitions lead to social anxiety and submissive withdrawal. *Cognitive Therapy and Research*, *33*(4), 375-389.

Wenzel, A., & Cochran, C. K. (2006). Autobiographical memories prompted by automatic thoughts in panic disorder and social phobia. *Cognitive Behaviour Therapy*, *35*, 129-137.

Wild, J., & Clark, D. M. (2011). Imagery rescripting of early traumatic memories in social phobia. *Cognitive and Behavioral Practice*, *18*, 433-443.

Williams, J. M. G., Barnhofer, T., Crane, C., Hermans, D., Raes, F., Watkins, E., et al. (2007). Autobiographical memory specificity and emotional disorder. *Psychological Bulletin*, *133*, 122-148.

Williams, J. M. G., & Broadbent, K. (1986). Autobiographical memory in suicide attempters. *Journal of Abnormal Psychology*, *95*, 144-149.

Zachary, R. A. (1986). *Shipley institute of living scale: Revised manual*. Los Angeles, CA: Western Psychological Services.

Zlomuzica, A., Dere, D., Machulska, A., Adolph, D., Dere, E., & Margraf, J. (2014). Episodic memories in anxiety disorders: Clinical implications. *Frontiers in Behavioral Neuroscience*, *8*, 398-416.

Table 1.

Frequencies of Endorsed Images and Memories Retrieved Across Participant Groups

	SAD ($N = 41$)	HC ($N = 40$)	$X^2(1)$
Endorsed Aversive Image? Total n (% of group N)	35 (85.4%)	34 (85%)	.00 [ns]
Endorsed Aversive Memory? Total n (% of n with negative images)	27 (77.1%)	30 (88.2%)	.81 [ns]
Endorsed Non-Aversive Image? Total n (% of group N)	28 (68.3%)	32 (80%)	1.4 [ns]
Endorsed Non-Aversive Memory? Total n (% of n with positive images)	20 (71.4%)	22 (68.8%)	.20 [ns]

Note. SAD = Social Anxiety Disorder; HC = Healthy Controls; [ns]ps > .17.

Table 2.

Memory Characteristics of Recollected Social Events Based on the Largest Possible Sample of Participants Across Groups Who Retrieved Either Aversive or Non-Aversive Memories

	Aversive		Non-Aversive	
	SAD ($n = 27$)	HC ($n = 30$)	SAD ($n = 20$)	HC ($n = 22$)
Total internal details - *M (SD)*	57.9 (26.4)	41.0 (21.8)	53.0 (24.8)	40.9 (20.0)
Positive internal details	3.1 (2.9)	3.1 (3.8)	12.8 (8.0)	8.8 (6.9)
Negative internal details	22.1 (10.3)	13.1 (11.3)	5.4 (9.0)	3.9 (4.8)
Neutral internal details	32.7 (19.5)	24.7 (14.2)	34.9 (16.3)	28.1 (14.9)
Total external details - *M (SD)*	34.4 (34.6)	26.2 (21.5)	34.9 (33.1)	28.5 (23.7)
Positive external details	1.6 (1.9)	1.2 (1.7)	5.2 (4.6)	2.8 (3.7)
Negative external details	12.0 (17.7)	5.1 (6.4)	6.3 (9.7)	1.5 (2.8)
Neutral external details	20.9 (17.7)	19.9 (16.7)	23.5 (22.8)	24.2 (22.1)
Neg affect at retrieval – *M (SD)*	48.3 (17.3)	30.4 (18.8)	14.7 (5.2)	17.0 (13.1)
Pos affect at retrieval - *M (SD)*	20.3 (6.8)	30.6 (19.3)	41.1 (18.8)	51.2 (20.7)
Vividness – *M (SD)*	7.7 (1.3)	6.2 (2.0)	7.1 (1.7)	7.5 (2.1)
Intrusiveness – *M (SD)*	5.7 (2.6)	3.2 (2.1)	4.0 (2.5)	3.9 (2.6)
Influences self-views – *M (SD)*	6.6 (2.3)	3.6 (1.7)	4.4 (2.1)	4.4 (2.6)

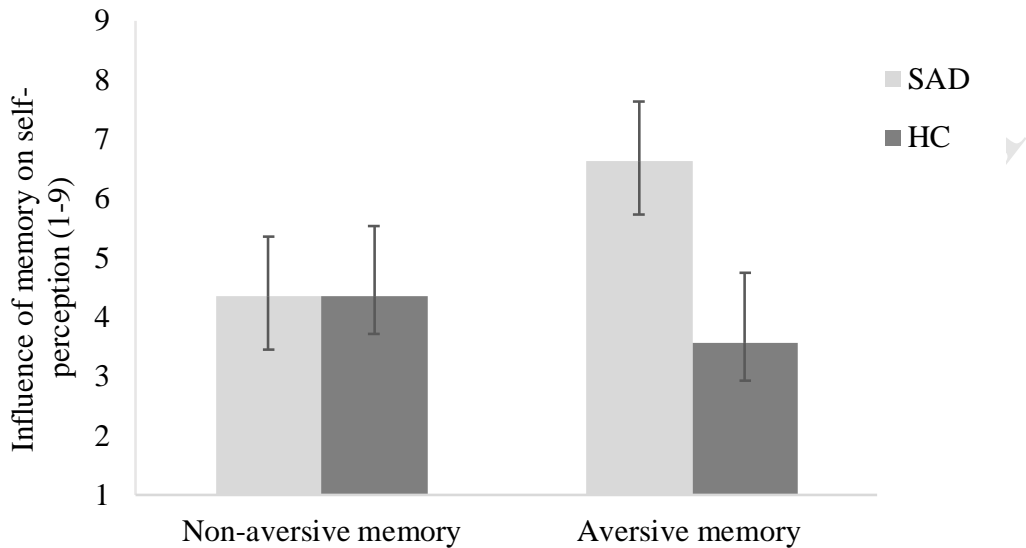*Note.* SAD = Social Anxiety Disorder; HC = Healthy Controls

Figure 1. Memories of aversive social experiences were appraised as influencing self-perception to a significantly greater degree by participants with social anxiety disorder (SAD) than by healthy controls (HCs). No difference between the groups was observed for appraisals of non-aversive social memories. Error bars represent 95% confidence intervals.

Appendix

1. Example of a SAD participant's coded memory narrative (main event: going to a party at a pub)

[internal; neutral]   [internal; neutral]   [internal; neutral]
It was a social event that I attended to meet new people. It was a group that I found. It was in a

[internal; neutral]   [internal; neutral]   [internal; neutral]
bar, like in a pub environment and they told me everyone would be at the back. It was around, 25

[internal; neutral]   [internal; neutral]   [external; neutral]
people. I arrived there and I went very nicely dressed up, but as soon as I got there and I

[internal; neutral]   [internal; negative]
saw the huge group at the back of the room, I started getting very nervous and I was feeling

[internal; negative]   [internal; negative]   [internal; negative]   [external; negative]
cold, and I felt my heart beating really fast. I didn't want to approach, I was very nervous, very

[internal; negative]   [internal; neutral]   [external; neutral]
scared. But I pushed myself, I pushed myself out of my comfort zone. I arrived and I just

[internal; negative] [internal; negative]   [internal; neutral]
couldn't talk. I was frozen. Part of me kept pushing me to try to become, uhh, part of the

[internal; negative]   [internal; negative]
group, but it was really hard for me to talk to people. I felt like I was being rejected even when it

[internal; neutral]   [internal; neutral]   [internal; negative]
wasn't the case, because they were talking to me, I just felt I didn't belong. I felt that they were

[internal; negative]   [internal; negative]   [internal; neutral]
just, I was being judged and rejected. So I sat there hoping more people to come talk to me

[internal; neutral]   [internal; neutral]
but I had to put part of myself to, to go and talk to people, cause no one really knows each other,

[internal; neutral]   [external; negative]   [internal; negative]
[internal; neutral]
even when they look so comfortable. I felt like I was like frozen, not part of it. So, I ordered a

[internal; neutral]   [internal; negative]
drink. I stayed there for like half an hour, feeling the same uncomfortable and I ended up leaving

[internal; neutral]   [internal; negative]   [internal; negative]   [internal;

negative]
without anyone noticing. To escape out of my anxiety and awkwardness, cause I wasn't being

[internal; negative]   [internal; negative]
myself… I couldn't talk, I was just sitting there talking to no one.

2. Example of an HC participant's coded memory narrative (main event: a date in a restaurant)

[internal; neutral]   [internal; neutral]   [internal; neutral] [internal; neutral]
So, the event, I was on a date, he had black hair, he was Asian, he wasn't tall. He was like my

[internal; neutral]   [internal; neutral]   [internal; neutral]   [internal; neutral]   [internal;
neutral]
height, he was wearing a dress shirt. We dressed up and went on a date, so I wore a dress. And

[internal; positive]   [internal; neutral]   [internal; neutral]
we both looked good, it was sunny outside, the specific image so yeah it was in Famoso's. We

[internal; neutral]   [internal; positive]   [external; neutral]
were sitting at a high table, and we were laughing about something, I can't remember

[internal; negative]   [external; neutral]
what, and then I remember thinking in my head oh my god why did I just say that. I don't know

[external; neutral]   [internal; neutral]
why I remember that but that's what I remember. And he's wearing a blue dress shirt. There's

[internal; neutral]   [internal; neutral]   [internal; neutral]
other people in the restaurant too. Yeah we had drinks too, and we both had pizza, yeah.

Highlights

- Examined aversive/non-aversive memory retrieval in social anxiety disorder (SAD)

- SADs and controls equally accessed aversive and non-aversive memories

- SADs' aversive memories contained richer episodic detail than those of controls

- SADs appraised aversive memories as more distressing, intrusive, and self-relevant

- No group differences observed in recall or appraisals of non-aversive memories