



Retrieval properties of negative vs. positive mental images and autobiographical memories in social anxiety: Outcomes with a new measure

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ABSTRACT

High ($n = 41$) and low ($n = 39$) socially anxious (SA) participants completed the *Waterloo Images and Memories Interview* (WIMI), a new assessment tool that measures the accessibility and properties of mental images and associated autobiographical memories that individuals may experience across both anxiety-provoking (negative) and non-anxiety-provoking (positive) social situations. Results indicated that both high and low SA individuals experience negative images and associated autobiographical memories in anxiety-provoking social situations, but the rates of endorsement of such images and memories among high SA participants were substantially lower than those reported in recent studies. Moreover, whereas low SA individuals were capable of accessing a relatively balanced array of both negative and positive self-representations that were rich in episodic detail, high SA individuals retrieved a higher, more unbalanced ratio of negative-to-positive images and memories, as well as impoverished positive images that were significantly degraded in episodic detail. Finally, negative images influenced the two groups differently, with high SA individuals experiencing more negative emotional and cognitive consequences associated with bringing such images to mind. These results are discussed in relation to theoretical models of learning and memory within the context of contemporary cognitive behavioral models of social anxiety.

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Introduction

Cognitive models of social anxiety disorder (SAD) emphasize the central role of negative self-perception in the development and maintenance of anxiety symptoms (Clark & Wells, 1995; Hofmann, 2007; Moscovitch, 2009; Rapee & Heimberg, 1997). Negative self-perception in social anxiety is often represented in the form of intrusive, negatively distorted mental self-images that are viewed from the perspective of a critical observer and are erroneously perceived by socially anxious individuals as representing how they actually appear to others in social situations (Coles, Turk, & Heimberg, 2002; Coles, Turk, Heimberg, & Fresco, 2001; Hackmann & Holmes, 2004; Hackmann, Surawy, & Clark, 1998; Wells, Clark, & Ahmad, 1998). When these images are held in mind, they have been shown to increase anxiety and

self-concealment behaviors, facilitate negative interpretations of social events, and impair both subjectively-perceived and objectively-rated social performance (Hirsch, Clark, Mathews, & Williams, 2003; Hirsch, Clark, Williams, Morrison, & Mathews, 2005; Hirsch, Mathews, Clark, Williams, & Morrison, 2006; Stopa & Jenkins, 2007; Vassilopoulos, 2005).

Negative self-images in social anxiety are believed to be rooted in earlier experiences of social humiliation, criticism, or rejection (Hirsch & Clark, 2004). In an oft-cited study, Hackmann, Clark, and McManus (2000) interviewed participants with SAD and reported that 100% of them endorsed experiencing negative images in anxiety-provoking social situations. Furthermore, all participants but one (96%) were able to recall specific negative autobiographical events that they believed led to the formation of their images and occurred around the time of the initial onset of their social anxiety symptoms. These remarkable findings are consistent with the notion that studying the recall and content of autobiographical memories in individuals with problematic social anxiety may facilitate our understanding of their life-story narratives that are based on internal representations of the self

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and become accessible (i.e., are brought to mind) within the context of particular emotional states (e.g., [Blinder, 2007](#); [Conway & Pleydell-Pearce, 2000](#)). Indeed, such studies have helped generate new clinical insights into how best to treat the distortions in self-perception that characterize SAD ([Morgan, 2010](#); [Stopa, 2009](#)), with preliminary research indicating that patients with SAD (and related emotional disorders) may benefit significantly from learning during therapy to access and rescript the negative images and autobiographical memories that underlie their negative views of self and concomitant symptoms of social anxiety ([Holmes, Arntz, & Smucker, 2007](#); [Wild, Hackmann, & Clark, 2007, 2008](#)).

Despite these advances in our understanding and treatment of social anxiety, it is surprising that individuals with SAD would *universally* experience negative images in social situations and that they are able, with very few exceptions, to link such images to earlier, specific conditioning events that are encoded as traumatic memories. Indeed, this conclusion is at odds with results of other studies, which, using varied assessment methods, have shown far more conservative rates of recalled negative social conditioning events in socially anxious samples. For example, memories of socially traumatic events were endorsed as the cause of symptom onset in only 13% of individuals with SAD in a study by [Harvey, Ehlers, and Clark \(2005\)](#), and in none of the participants with “speech phobia” who were interviewed by [Hofmann, Ehlers, and Roth \(1995\)](#).

To be fair, it is hard to compare the endorsement rates of memories across studies because of the methodological differences between them, including discrepancies in methods used to cue memory retrieval, as well as the inherent difficulties involved in verifying the authenticity of participants’ retrospectively reported autobiographical experiences ([Brewin, Gregory, Lipton, & Burgess, 2010](#)). Nevertheless, a closer look at the methodological features of [Hackmann et al.’s \(2000\)](#) seminal study does raise some concern, specifically about the possibility that their interview may have generated an inflated number of false positive responses. [Hackmann et al.’s \(2000\)](#) participants were individuals with SAD who had undergone a full course of cognitive behavioral therapy (CBT) beginning six months prior to the interview and were instructed to *reflect back in a retrospective fashion on their experiences before they began treatment* and describe any images and memories they may have had at that time. Because participants had just completed a highly efficacious treatment (i.e., [Clark et al., 2003](#)) that significantly improved their symptoms ([Hackmann et al., 2000](#); p. 603, [Table 1](#)), their responses may have been contaminated by a retrospective bias (i.e., now that their symptoms had improved, believing that their experiences prior to treatment were more negative than they actually were). Moreover, [Hackmann et al. \(2000\)](#) reported that, prior to being interviewed, the typical participant in their study was not consciously aware of the link between his or her negative images and earlier autobiographical experiences. This is concerning because the interviewers in the [Hackmann et al.](#) study were not blind to the diagnostic status of participants or to study hypotheses and, thus, may have probed in an overly keen manner for phenomena they believed, a priori, to exist but of which the participants either were not aware or whose import they did not appreciate. Furthermore, if patients were eager to please the interviewer and avoid appearing contrary, they may have over-endorsed the sorts of experiences for which the interviewers probed.

Thus, a crucial next step in this area of research involves establishing a new paradigm for measuring images and memories in socially anxious individuals in a manner that is not hampered by unreliable measurement and related methodological problems.

Table 1
Characteristics of participant groups.

	High SA (n = 41)	Low SA (n = 39)
Age in years (SD)	19.5 (1.79)	20.19 (3.26)
Gender (% female)	72.5%	53.8%
Ethnicity		
Caucasian	35.0%	36.1%
Asian	55.0%	41.7%
Other	10.0%	22.2%
Most anxiety-provoking social situation		
Public speaking	68.3%	56.4%
Performing task under observation	2.4%	17.9%
Interacting at parties	12.2%	5.1%
Going on a date	2.4%	7.7%
Interacting with authority figures	7.3%	5.1%
Other	7.2%	7.8%
Least anxiety-provoking social situation		
Interacting with good friends	51.2%	43.6%
Interacting with family	12.2%	2.6%
Interacting with partner	2.4%	2.6%
Interacting one-on-one	14.6%	25.6%
Interacting in small groups	9.8%	10.3%
Interacting with new people	0%	7.7%
Interacting with subordinate people	7.3%	5.1%
Other	2.5%	2.6%

To this end, several studies have investigated the nature of autobiographical memory recall in clinical and analog samples using the standardized *Autobiographical Memory Test (AMT)* ([Williams & Broadbent, 1986](#)), in which participants are instructed to retrieve and describe a specific personal memory that comes to mind within a specified time period (e.g., 30 s) in response to several negative and positive cue words (see [Williams et al., 2007](#), for a review). Retrieved memories are later coded as being specific (i.e., an event that happened at a particular place and time and lasted for a day or less) or general (i.e., any non-specific event) by research assistants blind to the group status of participants. The percentage of specific memories that participants retrieve in response to the AMT cue words is calculated and used as the primary dependent variable in subsequent analyses. Although a comprehensive review of the literature is beyond the scope of this article, the emerging pattern of results across numerous studies (see [Williams et al., 2007](#)) is that people with a history of depression and post-traumatic stress have difficulty retrieving specific autobiographical memories (a phenomenon that has become known as an *overgeneral memory bias*), but people with other clinical diagnoses, including SAD, have not demonstrated this bias ([Heidenreich, Junghanns-Royack, & Stangier, 2007](#); [Wenzel & Cochran, 2006](#); [Wenzel, Jackson, & Holt, 2002](#); [Wenzel, Werner, Cochran, & Holt, 2004](#)).

For the purpose of investigating autobiographical recollections in social anxiety, however, the AMT is limited by: (a) its use of single words as cues for the generation of memories, which may not activate the retrieval of autobiographical memories that are associated with salient mental images; (b) its relatively minimal and subjective coding system, which requires coders to make a holistic judgement about the retrieved memory as being specific or general without taking into consideration the complexity of memory narratives that typically contain both specific and general components (e.g., [Levine, Svoboda, Hay, Winocur, & Moscovitch, 2002](#)); and (c) its operationalization of specific memory retrieval as a binary, categorical outcome measure (i.e., present or absent), which precludes the possibility that memory accessibility may be better conceptualized as a dimensional phenomenon, which

would, in turn, enable descriptions of autobiographical memories as being partially accessible or degraded in detail.¹

In the present study, we introduce the *Waterloo Images and Memories Interview* (WIMI), a modified version of the *Autobiographical Interview* (AI; Levine et al., 2002). The AI has been widely used over the past decade in memory research to measure the properties of participants' autobiographical memory narratives, to quantify the components of autobiographical memory recall (e.g., episodic vs. semantic details),² and to examine the impact of neuropsychiatric conditions (e.g., amnesia) on the types of details recalled (e.g., Rosenbaum et al., 2008). The WIMI protocol is administered by trained interviewers who are blind to the group status of participants. Retrieval of mental images and associated autobiographical memories for both anxiety-provoking (*negative*) and non-anxiety-provoking (*positive*) social situations is examined in each participant across two conditions: (a) *recall*, in which participants are instructed to speak in an extemporaneous manner without interviewer questioning or cuing; and (b) *specific probe*, in which the interviewer asks several follow-up questions to encourage participants to provide more elaborate detail on their images and memories. As in the AI, participants' narratives are audio-recorded, transcribed, and later coded by trained research assistants who are also blind to study parameters. Alongside the interview, participants also complete a number of self-report measures to assess their subjective experiences related to bringing their images and memories to mind (see Method section, below, for a more complete description). The WIMI enables researchers to investigate the impact of different moderators, including psychiatric diagnoses (e.g., SAD), on the types of details that participants retrieve across positive and negative social images and memories.

In this study, the WIMI was administered to high and low socially anxious (SA) participants. We hypothesized that relative to low SA participants, high SA participants would: (a) endorse experiencing a greater number of negative images and memories, as well as fewer positive ones; (b) show enhanced recollection of episodic details for negative images and memories, as well as diminished recollection of such details for positive images and memories; (c) report that their negative images and memories are more vivid and intrusive and more likely to be viewed from an observer's perspective; (d) report that negative images and memories are characterized by themes of concern about the self (e.g., Moscovitch, 2009); and (e) report that bringing negative

images and memories to mind leads to increases in subjective negative affect and decreases in positive affect. Finally, we wished to explore whether endorsement rates of negative images and memories among high SA participants on the WIMI resembled those of previous reports using different interview procedures (e.g., Hackmann et al., 2000).

Method

Participants

Several standardized prescreening questionnaires, including the *Social Phobia Inventory* (SPIN; Connor et al., 2000), were administered by faculty researchers to all potentially eligible participants in the undergraduate Psychology research pool at the University of Waterloo in Canada. High and low SA individuals from that pool were invited to participate if their scores on the SPIN met a cutoff of above 30 or below 12, respectively, as described in more detail below. Eighty individuals (41 high SA) were recruited to participate in the present study. All participants provided informed consent, were administered the WIMI, and completed a number of self-report questionnaires. The interview was administered by a trained research assistant who was blind to the group status of participants.

Administration of the WIMI

As described above, the WIMI elicits descriptions of: (a) any specific, recurrent mental images that participants consciously experience within their most anxiety-provoking (*negative*) and least anxiety-provoking (*positive*) social situations; and (b) associated autobiographical memories of events that participants can recall from a specific time and place, which they perceive as being related to the formation of the reported mental images. Time of administration of the WIMI depends on whether participants endorse or deny experiencing negative and/or positive images and associated memories; in the present study, administration of the interview typically lasted about 60 min per participant.

Interview preamble

The interviewer (who was blind to the anxiety group status of each participant) read the following standardized script at the start of the interview:

You were selected to participate in this study either because you tend to get nervous in social situations or because you tend not to get that nervous. Now, please do not tell me which one is true of you; for the purposes of this study it's important that I don't know. But does one of those sound true of you? Most people have some social situations that sometimes make them nervous. Social situations include things such as having one-on-one conversations, dating, speaking in front of a group of people, or trying to perform a task while other people are watching. Can you tell me what types of social situations make you especially nervous?

And likewise, even if certain social situations can be difficult for you, most people who feel nervous in some social situations have other social situations in which they feel pretty calm. Can you tell me what types of situations you feel especially comfortable in?

Before we get started with the interview, I want to clarify and check in with you about a few preliminary, important things. First of all, I want to reassure you that everything you say today and all of your responses on the questionnaires will be kept strictly confidential. All of your data will be kept in a locked cabinet and only the researchers involved in the study will have access to them. So protecting your confidentiality is very important to us and we take

¹ Two studies have recently investigated the subjective characteristics (D'Argembeau, Van der Linden, d'Acremont, & Mayers, 2006) and linguistic properties (Anderson, Goldin, Kurita, & Gross, 2008) of autobiographical recollections in socially anxious samples using methods other than the AMT. Anderson et al. (2008) analyzed the linguistic properties of autobiographical memory narratives of patients with SAD and found that they contained more self-referential, anxiety-related, and sensory/perceptual words than those of non-anxious controls. D'Argembeau et al. (2006) found that participants with SAD reported that their autobiographical memories across events contained less sensory/perceptual information and more self-referential information than those of non-anxious controls, that memories of social relative to non-social events contained more self-referential than other-referential information, and that both positive and negative social events were more likely to be remembered from an observer perspective. Of note, and perhaps because of differences in their methodological approaches, D'Argembeau et al. (2006) and Anderson et al. (2008) reported conflicting results about whether sensory/perceptual details in autobiographical memory are enhanced or degraded among individuals with SAD relative to non-anxious controls.

² Memory researchers distinguish between the semantic memory system, which encodes meaningful facts about the world, and the episodic memory system, which records specific experiences that occur at a particular time and place (Tulving, 1972). Autobiographical memory is considered a subtype of episodic memory that is involved in the encoding and retrieval of personally significant life experiences (e.g., Conway, 1990, 2009).

it very seriously. If it is okay with you, I would like to audio record today's interview, so that we can go back and code some of your responses at a later date. Would that be okay?

Second, during our interview today, I will be asking you to tell me about a number of different events or memories from your life. I will ask you to describe these events and then I will ask you some questions about them. When I ask you about an event from your life, I would like you to tell me about something that happened to you at a specific time and place. So, for example, describing a 3-week vacation would not be what I'm looking for, but if you tell me about a specific incident or experience that happened to you on one day during a 3-week vacation, that would be exactly what I'm looking for. Do you have any questions about what types of events we'd like you to tell us about? Some of the questions I will ask you during today's interview will be about mental images that you may have in different kinds of situations. A mental image is a mental representation or impression that enters your mind. It is often a picture that you see in your mind. Although images are often visual, they may also involve other sensory components, including sound, taste, smell, or touch.³

When I ask you to describe mental images you might typically have in certain situations, what I'll be asking is for you to think about whether you tend to experience any sensory representations or impressions that spontaneously pop into your mind when you enter or anticipate entering these situations. For example, if I ask you whether you tend to have any mental images when you visit a hospital, I don't want you simply to describe what you imagine it would look or smell like in a hospital. Rather, I want you to think about whether some image tends to pop spontaneously into your mind when you enter or anticipate entering a hospital, such as, for example, an image of a person lying in bed with an IV in his arm, accompanied by the smell of rubbing alcohol, or an image of a caring angel hovering over a bed. Or perhaps it could be an image of a car crash that is only tangentially related to the hospital.

The image and sensory components that pop into your mind in certain situations may or may not correspond with reality and with experiences you know you've had previously in your life. For example, you might be aware that whenever you are about to enter a hospital, an image spontaneously comes to mind of a person with an IV in his arm accompanied by the smell of rubbing alcohol or of a caring angel hovering over a bed, even though you have no idea why one of these particular images tend to come up for you. Is the definition of a mental image clear to you? If you're unsure about whether you understand what I mean, please let me know now so I can help clarify what I mean (if elaboration was required, the interviewer repeated the above definition and example, but avoided giving examples related to any social situations).

Finally, as you answer the questions in this interview, please provide as much detail as you can remember in each of your responses. I am not looking for any specific types of details, but rather for you to describe as many of the little details as you can remember about the events and images that we ask you about. Please tell me everything that comes to mind or that you see in your mind's eye as you scan the image.

Assessment of images

Following the preamble, participants were asked to identify specific social situations and describe any mental images that may spontaneously arise in their minds immediately before or during their most or least (counterbalanced order) anxiety-provoking social situation (e.g., public speaking; dating situations; going to parties; conversations with friends, etc.). Participants were asked directly whether or not they have mental images during such situations. Participants who endorsed having a mental image were asked to describe the image in as much detail as possible in the *recall* and *specific probe* conditions, described below. Participants who denied having any images were, at this point, given a standardized description of mental imagery (i.e., "People who do have these types of images often say that they are like pictures or snapshots of themselves behaving or appearing a certain way; or images or snapshots of interacting partners or audience observers; or even snapshots of landscapes or scenes that seem frozen in time. Do any of these sound familiar to you?"), and given one additional opportunity to endorse having such images. If they continued to deny experiencing an image following this description, a *no* response was entered and the interviewer proceeded onto the next section of the WIMI.

Participants' descriptive narratives of their images were obtained under two conditions that differed according to the level of interviewer intervention: (a) *recall*, which was characterized by open-ended narratives that participants provide in as much detail as possible without any interviewer questioning or cuing; and (b) *specific probe*, in which the interviewer asked several open-ended follow-up questions to encourage participants to provide more elaborate detail on their images. In *recall*, participants were asked after they finished speaking whether there were any further details they wished to provide. In *specific probe*, interviewers were trained to ask 10–15 specific questions about the nature of the images that participants previously described during *recall*, with the explicit goal of allowing participants to elaborate on their previous descriptions.

Assessment of memories

Participants were then asked to recall memories of events that they perceived as being related to the image described in the previous section. This section then followed exactly the same format as the images section, described above. To elicit memories, each participant was asked: "Is there a particular event that happened at a specific time and place in your life that you can think of that may have led to the formation of the image we just talked about?" As in the images section, for any participant who denied experiencing a negative autobiographical memory linked to his or her negative image, the interviewer delivered the following standardized script describing such memories: "Although many people do report having these sorts of memories, some people do not. So, if you really believe you do not have any memory of this nature, please do let us know and we'll move on. People who do have such memories often report specific memories of negative social experiences that happened to them. These negative events are often related to behaving inappropriately, appearing awkward, or making mistakes in front of others, and being judged negatively, criticized, or rejected by people you wanted to make a good impression on. Do you recall any of these types of experiences happening to you that might be related to the mental images that pop into your mind in anxiety-provoking social situations?" For positive memories that participants initially denied, the following script was delivered: "Although many people do report having these sorts of memories, some people do not. So, if you really believe you do not have any memory of this nature, please do let us know and we'll move on. People who do have such memories often report specific memories of positive social experiences that happened to them. These positive events are often related to behaving competently and comfortably in a social situation, having a good time with

³ Other investigators have operationalized imagery in a manner that explicitly includes a definition of an 'impression' as 'a felt sense of how you were coming across,' which might help to capture kinesthetic elements of participants' images related to their bodily perceptions in anxiety-provoking social situations (see Hackmann et al., 2000). This definition was not explicitly provided to participants in the present study. Moreover, unlike in some previous studies, participants in the present study were not explicitly encouraged to close their eyes in order to facilitate the retrieval of images and memories, although we observed that a number of participants did, in fact, spontaneously close their eyes when they attempted to bring images and memories to mind.

others, and being praised or accepted by people you wanted to make a good impression on. Do you recall any of these types of experiences happening to you that might be related to the mental images that pop into your mind in social situations in which you feel comfortable?” If participants continued to deny experiencing a negative or positive memory, a *no* response was entered and the interviewer proceeded to the next section of the WIMI.

Rules for order of administration

The following rules were applied to the administration of the WIMI in the present study:

- Probes about negative or positive images always preceded probes about corresponding negative or positive memories.
- If participants denied experiencing a positive/negative image, the corresponding positive/negative memory section was not administered (i.e., the presence of linked memories could only be endorsed if the presence of images was endorsed).
- The *recall* condition (for both images and memories) always preceded the *specific probe* condition.
- The order of administration for anxiety-provoking (*negative*) vs. non-anxiety-provoking (*positive*) images and memories was counterbalanced across participants.

Thus, the order of administration always occurred as follows: (a) recall positive or negative image; (b) recall positive or negative memory; (c) specific probe of positive or negative image; (d) specific probe of positive or negative memory.

Coding of participant narratives

Image and memory narratives were audio-recorded and later transcribed and coded across pre-determined categories by trained research assistant coders 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), in which details are assigned to various phenomenological categories (described below), accounting for true episodic and non-episodic details separately. Thus, like the AI, the WIMI was designed specifically to enable researchers to distinguish between true autobiographical details in episodic memory (i.e., those pertaining to an event that was specific in both time and place) and factual details not connected to a particular time and place, which are part of semantic memory (Tulving, 1972).

Transcribed narratives of each positive and negative image and memory were coded separately for *recall* and *specific probe*, thus yielding a maximum of 8 separate narratives per participant that required coding. Narratives were coded segment by segment, with each segment representing a separate utterance, as in Levine et al. (2002). Each segment was coded as falling into only one of the pre-determined categories, which were as follows:

- (1) general event details (episodic details about the specific image or event that cannot be classified in categories 2–8, below; e.g., details about when or where the event happened);
- (2) perceptual details (episodic details reflecting sensory information; e.g., specific sounds, smells, the look on someone's face, etc.);
- (3) negative episodic details about the self;
- (4) positive episodic details about the self;
- (5) negative episodic details about others;
- (6) positive episodic details about others;
- (7) negative affective episodic details (descriptions of negative emotions related to the image or event)

- (8) positive affective episodic details (descriptions of positive emotions related to the image or event);
- (9) semantic details (factual details that are not connected to a specific event during a circumscribed moment in time and place; e.g., “I used to love to swim as a child.”); and
- (10) external details (details pertaining to an image/event other than the one being discussed).

Some of these categories were derived from the AI but modified to suit our needs, while others were chosen to reflect cognitive and affective features that are relevant to social anxiety (e.g., Moscovitch, 2009). Categories 1–8, above, represent narrative details that reflect episodic recollection of the particular image or event in question. While each of these categories could also be examined independently of the others, the 8 categories were summed together into a composite category labelled *total episodic internal details*, as in the AI (Levine et al., 2002). This category represents a measure of episodic memory richness or recollection, and the number of details within this composite category across groups and conditions was then compared with the number of non-episodic details (the sum of the *semantic* plus *external* categories), as illustrated in Table 7 (and described in more detail below).

Coder training

Using numerous examples of WIMI narratives from pilot data, three senior undergraduate research assistants were first trained to attain 90% agreement with an expert coder who was originally trained on the AI (Tatiana Bielak). Then, prior to coding participant narratives in the present study, a coding proficiency test was conducted, in which each of the undergraduate coders independently coded one of the pilot participant's image and memory narratives (i.e., the same narratives were coded by all three WIMI coders). Interclass correlation coefficients (ICCs; absolute agreement; two-way mixed model) were calculated. Results indicated that two-way ICCs amongst each pair of coders ranged from .92 to .94, and the three-way ICC was .93. Following the training phase, each coder was assigned responsibility for independently coding the WIMI narratives of different participants. Participants' narratives were placed in a common pool and scored at random. No narratives were coded by more than one coder.

Graphical representations of reported images

Following the interview, participants were provided blank pieces of 8½ × 11 white paper and a package of pencil crayons and instructed to “*please draw a sketch or representation of your negative and positive images on these two pieces of paper using the materials provided; include as many details as you can in your sketches.*” Participants were allotted 5 min per image to complete their sketches, which were elicited purely for exploratory and descriptive purposes. We reasoned that because images typically are experienced by participants as mental pictures, the illustrations might complement participants' verbal narratives to provide a rich graphical description of the phenomenon under investigation. Two examples of participant sketches are presented in Fig. 1.

Subjective ratings

Participants rated the properties of each image and memory endorsed on the WIMI on a 10-point scale from 1 (not at all) to 10 (extremely) across the following dimensions:

- (1) *Vividness* (while envisioning/remembering the image/event, I could see it clearly in my mind).

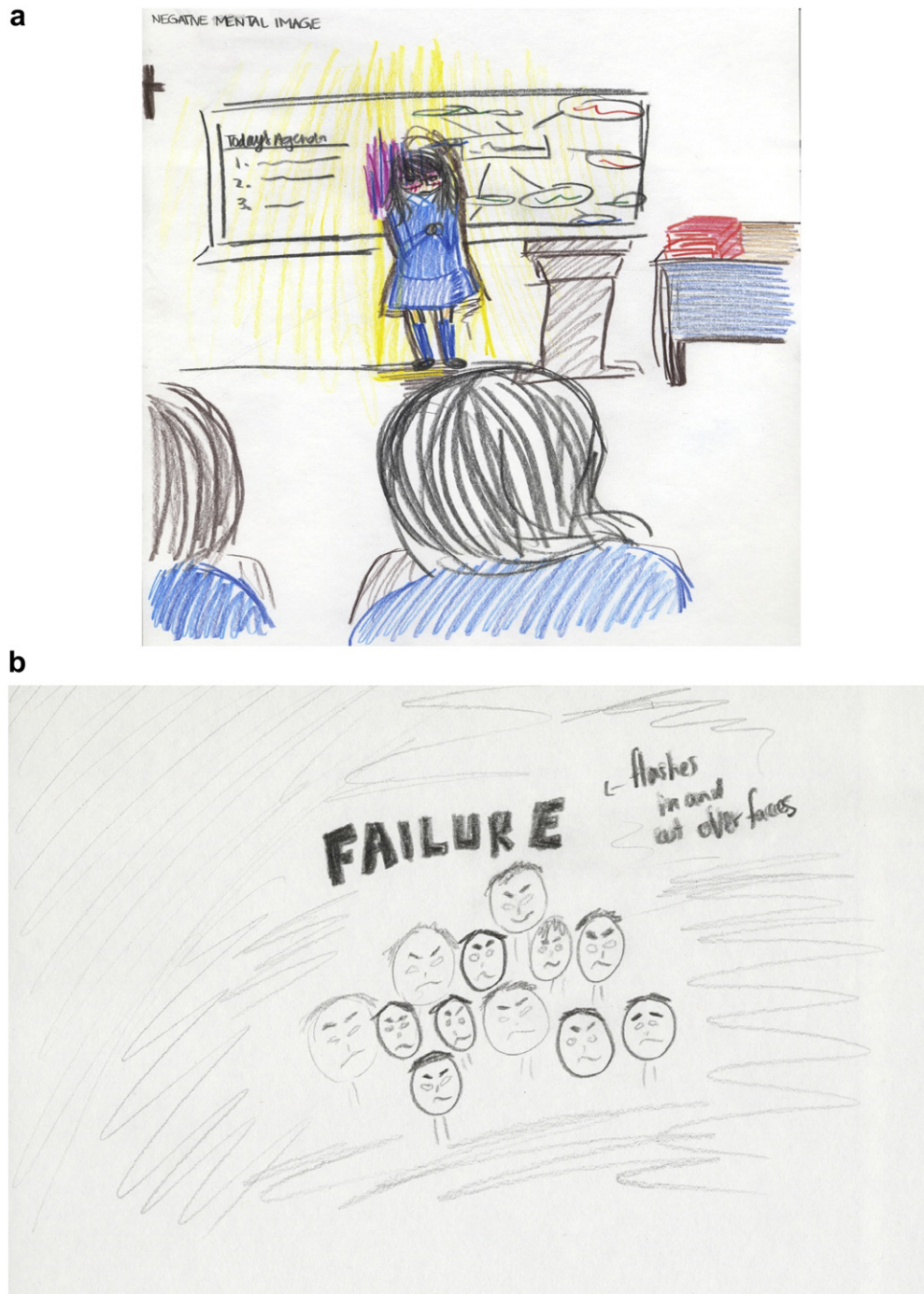


Fig. 1. (a and b). Examples of participant sketches of their negative images. The image depicted in Fig. 1a was described by the participant during the WIMI as follows: "I can see myself playing with my hands a lot. Just kind of fidgeting with my fingers, trying to get the words out but I can't and I am hunched over a bit like this and I'm really, really nervous. It's almost like withdrawing myself a bit where it's not an open posture, but a closed posture and trying to get the words out and I can't. Just a lot of jittering and fidgeting..." The central figure in the image was drawn surrounded by a yellow "spotlight." The image depicted in Fig. 1b was described by the participant during the WIMI as follows: "When I get really nervous, my heart starts beating and I can see the image of just people, faceless, and then kind of over top of this it says *failure* written in big black block letters. With the image comes a lot of emotion of fear and failure and just unsuccessful, all negative feelings ... It's a very simple image but I think it's powerful for me." The entire sketch was drawn in black and white.

- (2) *Field perspective* (while envisioning/remembering the image/event, I could see it out of my own eyes rather than those of an outside observer).
- (3) *Negative affect during retrieval* (while envisioning/remembering the image/event, I felt ____). Participants responded to 10 negative affect (NA) items, which consisted of the NA adjectives

- from the *Positive and Negative Affect Schedule* (PANAS; Watson, Clark, & Tellegen, 1988). A mean NA value (sum of all items/10) was created for each participant.
- (4) *Positive affect during retrieval* (while envisioning/remembering the image/event, I felt ____). Participants responded to 10 positive affect (PA) items, which consisted of the PA adjectives

from the PANAS. A mean PA value (sum of all items/10) was created for each participant.

- (5) *Intrusiveness* (this image/memory has previously come to me out of the blue, without my trying to bring it to mind).
- (6) *Influences views of self, others, and the world* (the image/event just discussed influences how I view myself/others/the world).

Participants also rated on the same 1–10 scale the extent to which concerns about specific self-attributes were represented in the images they endorsed on the WIMI. For this purpose, we used the 27 negative adjective items from the *Negative Self-Portrayal Scale* (NSPS; Moscovitch & Huyder, 2011) – described below in Section 2.7 – but adapted the instructions so that participants were asked: *Please indicate the degree to which the picture of yourself in the mental image just described contains the following characteristics. As in the original measure, the following subscale responses were derived:*

- (a) *NSPS total* (sum of all items).
- (b) *NSPS social competence* (sum of items measuring concerns about social competence).
- (c) *NSPS signs of anxiety* (sum of items measuring concerns about signs of anxiety).
- (d) *NSPS physical appearance* (sum of items measuring concerns about appearance).

Self-report measures

All participants completed the following self-report measures immediately after the administration of the WIMI and associated questionnaires:

The *Social Phobia Inventory* (SPIN; Connor et al., 2000) is a 17-item self-report instrument that measures fear, avoidance, and physiological discomfort in social situations (e.g., fears of people in authority; avoids parties; distressed by sweating). Each item is rated on a scale from 0 (not at all) to 4 (extremely), with higher scores representing greater levels of distress; thus, the full scale score ranges from 0 to 68. In this study, the SPIN was administered at prescreening up to several weeks prior to testing in the laboratory and then again at the end of the interview on the day of testing. Although Connor et al. (2000) proposed a cutoff score of 19 and higher to select participants likely to have SAD, others (e.g., Moser, Hajcak, Huppert, Foa, & Simons, 2008) have expressed a preference for using a more stringent cutoff score of 30, which we used in the present study to select participants with high levels of SA at prescreening. We selected a cutoff score of 12 or below for the low SA group because Connor et al. (2000) reported that their nonpsychiatric control group had a mean SPIN total score of 12.1. This cutoff score resembles the score of 10 or below that has been used by Moser et al. (2008) to identify low anxious controls. The SPIN has been shown to be an excellent measure of social anxiety, with good test–retest reliability, strong convergent and divergent validity, good construct validity and high levels of internal consistency (Antony, Coons, McCabe, Ashbaugh, & Swinson, 2006; Connor et al., 2000). For both SPIN administrations in the present study (i.e., at prescreening and on the day of testing after the administration of the WIMI), Cronbach's alpha was .94.

The *Beck Depression Inventory II* (BDI-II; Beck, Steer, & Brown, 1996) is a 21-item measure that is commonly used for detecting symptoms of depression in both normal and clinical populations. Respondents are instructed to choose the statement amongst a group of statements that best applies to how they generally feel. Each group of statements ranges from 0 (e.g., “I do not feel sad”) to 3 (e.g., “I am so sad or unhappy that I can't stand it.”). The BDI-II has consistently been shown to have adequate test–retest reliability ($r = .60–.83$ in

nonclinical samples and $r = .48–.86$ in clinical samples), good convergent and discriminant validity (e.g., it has been found to be significantly more strongly correlated with depression relevant measures, such as the Beck Hopelessness Scale, than with measures of anxiety, $p < .01$), and high internal consistency (Cronbach's alpha indices of .76–.95 in clinical populations and .73–.92 in nonclinical populations; Osman, Barrios, Gutierrez, Williams, & Bailey, 2008). In the current study, Cronbach's alpha was .92.

The NSPS (Moscovitch & Huyder, 2011) is a new questionnaire designed to assess the extent to which individuals are concerned that specific self-attributes they view as being deficient will be exposed to scrutiny and evaluation by critical others in social situations. Across two large samples of North American undergraduate students with normally distributed symptoms of social anxiety, exploratory and confirmatory factor analyses supported a (non-orthogonal; i.e., oblique) 3-factor solution representing concerns about: (a) social competence; (b) signs of anxiety, and (c) physical appearance (Moscovitch & Huyder, 2011). The NSPS was found to have good internal consistency ($\alpha = .95$ for full scale and $\alpha = .87–.92$ for the 3 subscales) and test–retest reliability ($r = .75$). The NSPS also demonstrated adequate convergent and discriminant validity ($r = .63–.70$ with symptom measures of social anxiety, and $r = .47–.62$ with measures of OCD and depression). Hierarchical regression analyses revealed that NSPS total scores accounted for a significant proportion of unique variance in self-concealment (i.e., safety) behaviors over and above established symptom measures of social interaction anxiety, social performance anxiety, and depression. Alpha coefficients in the current study were .93 for the social competence subscale, .86 for the signs of anxiety subscale, .91 for the physical appearance subscale, and .95 for the total score.

The *Liebowitz Social Anxiety Scale – Self-Report Version* (LSAS-SR; Baker, Heinrichs, Kim, & Hofmann, 2002) is a 24-item version of a well-validated clinician-administered instrument (Heimberg et al., 1999) that assesses fear and avoidance, in separate subscales, across a number of social and performance situations. Each item is rated on a scale of 0 (None/Never) to 3 (Severe/Usually). Like the clinician-administered version, the LSAS-SR has been shown to have good test–retest reliability ($r = .83$), internal consistency (Cronbach's alpha of .95), and convergent and discriminant validity (e.g., among patients with SAD, correlations with other measures of social anxiety were found to be significantly stronger than correlations with measures of depression; Baker et al., 2002; Fresco et al., 2001). Alpha coefficients in the current study were .94 for the fear subscale, .93 for the avoidance subscale, and .97 for the total score.

The *Shipley Institute for Living Scale* (SILS; Shipley, 1940; Zachary, 1986) was developed originally as a screening test for organic brain damage, and has shown to have validity as a brief IQ test that correlates significantly with scores on full scale IQ tests, including the Wechsler Adult Intelligence Scale (e.g., see Bowers & Pantle, 1998). In the present study, we administered the 40-item Verbal section of the SILS, which yields a Verbal score based on the respondent's ability to choose the correct definition of a target word from four possibilities. The purpose of administering this measure in the present study was to ensure that the two groups were roughly equivalent in their cognitive/verbal abilities, so that any group differences in performance that may emerge on the WIMI could not be attributed to such differences per se.

The *Social History Questionnaire* (SHQ; Alden, Mellings, Taylor, & Laposa, in preparation) is a 21-item measure that assesses respondents' retrospectively reported social developmental experiences within their families of origin across four orthogonal factors: parental hostility, parental alcoholism, family socializing, and parental overprotection. Preliminary psychometric data are promising (Alden et al., in preparation). In the present study, we

administered the scale to examine whether there were any group differences in reported social developmental experiences, which we reasoned may help to account for any differences observed in endorsed negative memories on the WIMI. For the purposes of this study, only the SHQ total score was computed and reported. The SHQ in the current study demonstrated adequate internal validity (Cronbach's alpha = .68).

The *Social Probability and Cost Questionnaire* (SPCQ; McManus, Clark, & Hackmann, 2000) is a 33-item measure describing negative social events, in which participants rate the probability and cost (i.e., how bad it would be) of having each of these events occur to them in the near future on a scale from 0 (not at all likely/bad) to 100 (almost sure to happen/really bad). McManus et al. (2000) found that among socially anxious patients, both the probability and cost subscales demonstrated excellent internal consistency ($\alpha = .95$ for both subscales). Foa, Franklin, Perry, and Herbert (1996) reported alpha values ranging from .85 to .97 and found that the scale had satisfactory test–retest reliability (no significant changes on the subscale means when re-assessed after a 14-week interval). Cronbach's alpha coefficients in the current study were .95 for the probability subscale, .96 for the cost subscale, and .97 for the total score.

Results

Descriptive group characteristics

Descriptive characteristics of participants in both groups are presented in Table 1. Groups did not differ significantly in age, $t(76) = 1.15$, $p = .25$, ethnic composition (Caucasian, Asian, Other), $\chi^2(2) = 2.49$, $p = .29$, or gender composition, $\chi^2(2) = 2.43$, $p = .17$. Participants in both groups identified public speaking as their most anxiety-provoking social situation and interacting with close friends as their least anxiety-provoking social situation.

As displayed in Table 2, high and low SA participants differed significantly in the expected direction across the majority of self-report measures, including the SPIN, BDI-II, NSPS total, NSPS social competence, NSPS signs of anxiety, LSAS-SR fear and avoidance, and SPCQ probability and cost (all $t_s > 2.19$, all $p_s < .001$). High SA participants also reported higher concerns than low SA

Table 2
Comparison of participant group scores on self-report measures.

	High SA M (SD)	Low SA M (SD)	t-Test
SPIN (prescreening)	37.73 (6.13)	8.92 (8.54)	$t(77) = 17.25^*$
SPIN (day of testing)	35.1 (13.1)	13.3 (9.7)	$t(73) = 8.12^*$
BDI-II	15.8 (9.8)	7.4 (6.2)	$t(60) = 4.04^*$
NSPS total	72.5 (21.6)	51.3 (17.5)	$t(77) = 4.78^*$
Social competence	32.1 (9.7)	21.2 (8.5)	$t(77) = 5.30^*$
Signs of anxiety	22.3 (7.0)	15.5 (6.0)	$t(78) = 4.61^*$
Physical appearance	17.7 (8.8)	14.6 (5.7)	$t(78) = 1.88^{\dagger}$
LSAS-SR			
Fear	33.0 (12.7)	16.4 (9.6)	$t(77) = 6.48^*$
Avoidance	32.2 (13.7)	9.2 (13.7)	$t(77) = 7.32^*$
SILS	27.4 (4.7)	28.7 (3.7)	$t(77) = 1.46^{ns}$
SHQ total	41.5 (8.2)	43.3 (8.8)	$t(77) = 1.83^{ns}$
SPCQ			
Probability	1652.1 (473.8)	958.1 (569.0)	$t(76) = 5.85^*$
Cost	1707.6 (506.6)	932.3 (569.7)	$t(68) = 6.0^*$

Note. Differences in degrees of freedom across t -tests reflect differences in missing values across measures; SPIN = Social Phobia Inventory; BDI-II = Beck Depression Inventory II; NSPS = Negative Self-Portrayal Scale; LSAS – SR = Liebowitz Social Anxiety Scale – Self-Report Version; SILS = Shipley Institute for Living Scale; SHQ = Social History Questionnaire; SPCQ = Social Probability and Cost Questionnaire. * $p < .001$; $^{\dagger}p < .07$; $^{ns}p > .10$.

Table 3
Frequencies of endorsed images and memories between participant groups.

	High SA (N = 41)	Low SA (N = 39)	$\chi^2(1)$
Endorsed negative image? Total n (% of group N)	31 (75.6%)	25 (64.1%)	1.26 ^{ns}
Endorsed negative memory? Total n (% of n with negative images)	23 (74.2%)	19 (76.0%)	.01 ^{ns}
Endorsed positive image? Total n (% of group N)	15 (36.6%)	16 (41.0%)	.17 ^{ns}
Endorsed positive memory? Total n (% of n with positive images)	6 (40.0%)	10 (62.5%)	1.57 ^{ns}

Note. ^{ns} $p > .21$.

participants on the NSPS physical appearance subscale, but this difference was marginally significant ($p = .07$). Comparison of group scores on the SHQ indicated that high and low SA participants did not differ in terms of their reported social developmental experiences. Finally, scores on the SILS demonstrated that the groups did not differ in their verbal/cognitive abilities.

One-way ANOVAs demonstrated that there were no significant group differences in the number of specific probe questions asked by the interviewer or the length of time spent on each section of the WIMI (all $p_s > .13$).

Frequency of endorsed images and memories

Four between-groups chi-square analyses and four within-group chi-square analyses were conducted. The first set of analyses compared the relative frequency of endorsed negative images, positive images, negative memories, and positive memories *between* the two groups, and the second set compared the relative frequency of endorsed negative vs. positive images and negative vs. positive memories *within* each group separately.

As shown in Table 3, there were no between-group differences in the relative frequency of endorsed images or memories across the four categories. Seventy-six percent of high SA and 64% of low SA participants endorsed experiencing negative images. Seventy-four percent of high SA participants with negative images (56% of all high SA participants) endorsed associated negative autobiographical memories, relative to 76% of low SA participants with negative images (49% of all low SA participants).

The within-group analyses indicated that the relative proportion of endorsed (i.e., saying “yes, I experience those”) vs. denied (i.e., saying “no, I do not experience those”) negative vs. positive images and memories differed within the groups. As shown in Table 4, participants within both groups were more likely to endorse than deny experiencing negative images and more likely to deny than endorse experiencing positive images. However, the effect sizes associated with the proportion of endorsed vs. denied negative vs. positive images within each group suggest that low SA participants endorsed a more balanced (i.e., less extreme) mix of both positive and negative images relative to high SA participants, whose endorsed images were more heavily weighted toward the

Table 4
Frequencies of endorsed (“yes”) vs. denied (“no”) negative vs. positive images within (1) high and (2) low SA participants separately.

	1. High SA				2. Low SA			
	n	Yes	No	$\chi^2(1)$	n	Yes	No	$\chi^2(1)$
Negative images	41	31	10	12.68**	39	25	14	4.17*
Positive images	41	15	26		39	16	23	

Note. * $p < .05$; ** $p < .001$.

Table 5

Frequencies of endorsed (“yes”) vs. denied (“no”) negative vs. positive memories within (1) high and (2) low SA participants separately.

	1. High SA				2. Low SA			
	n	Yes	No	$\chi^2(1)$	n	Yes	No	$\chi^2(1)$
Negative memories	31	23	8	5.07*	25	19	6	.86
Positive memories	15	6	9		16	10	6	

Note. * $p < .05$.

negative. Moreover, an interesting pattern of results emerged across the two groups for the frequency of endorsed vs. denied negative and positive memories. As depicted in Table 5, both low and high SA participants were more likely to endorse than deny experiencing negative memories. However, low SA participants were also more likely to endorse than deny experiencing positive memories, whereas high SA participants showed the opposite pattern – i.e., more often denying than endorsing the experience of positive memories.

Subjective characteristics of images and memories

Planned group comparisons were conducted on participant ratings for negative images, positive images, negative memories, and positive memories separately. Means and standard deviations of these ratings are presented in Table 6. Several significant ($p < .05$) and marginally significant ($p < .10$) effects emerged.

For negative images, high relative to low SA participants reported: (a) marginally increased negative affect, $t(54) = 1.79$, $p = .08$, and marginally diminished positive affect, $t(55) = -1.96$, $p = .06$, during retrieval; (b) decreased vividness, $t(55) = -1.97$, $p = .05$; and (c) marginally greater influence of their images on their views of self, $t(55) = 1.93$, $p = .06$ and greater influence of images on their views of others, $t(55) = 2.04$, $p = .05$, and the world, $t(55) = 2.35$, $p = .02$. For positive images, there were no differences between high and low SA participants (all $ps > .10$).

Table 6

Subjective characteristics (M (SD)) of images and memories in high vs. low SA participants.

Variable	Images				Memories			
	Negative		Positive		Negative		Positive	
	High SA ($n = 31$)	Low SA ($n = 25$)	High SA ($n = 15$)	Low SA ($n = 16$)	High SA ($n = 23$)	Low SA ($n = 19$)	High SA ($n = 6$)	Low SA ($n = 10$)
Field perspective	6.0 (3.90)	6.96 (3.24)	7.07 (3.81)	5.38 (3.61)	7.39 (2.95)	7.74 (3.19)	9.5 (1.22)^l	5.2 (3.29)^l
Negative affect during retrieval	5.51 (1.49)^a	4.68 (1.94)^b	1.65 (1.2)	1.32 (.38)	4.84 (2.09)	4.77 (2.32)	1.63 (.72)	1.81 (1.79)
Positive affect during retrieval	2.76 (1.23)^b	3.60 (1.99)^b	5.37 (1.95)	6.27 (2.56)	2.68 (1.56)	3.51 (1.77)	5.37 (1.95)	6.27 (2.56)
Vividness	7.39 (1.36)^c	8.08 (1.26)^c	7.87 (1.41)	8.63 (1.15)	7.39 (1.99)	8.16 (2.09)	8.33 (1.21)	8.30 (1.42)
Intrusiveness	4.71 (2.87)	4.08 (3.27)	5.13 (3.54)	5.56 (2.97)	5.26 (3.03)	4.42 (2.87)	6.17 (3.19)	6.9 (2.02)
Influences views of self	6.10 (2.65)^d	4.65 (2.99)^d	5.93 (2.74)	5.56 (2.45)	5.73 (2.82)	5.16 (2.83)	5.17 (3.31)	4.5 (3.17)
Influences views of others	3.97 (2.88)^e	2.58 (2.14)^e	4.0 (3.27)	4.5 (2.73)	4.09 (2.66)	3.21 (2.82)	2.94 (1.20)	2.81 (.89)
Influences views of the world	3.52 (2.41)^f	2.23 (1.53)^f	3.93 (2.74)	3.56 (3.05)	3.74 (2.54)^k	2.42 (2.34)^k	5.0 (3.41)	2.9 (2.28)
NSPS total	123.21 (46.55)^g	79.96 (43.94)^g	44.5 (20.0)	35.19 (9.69)	N/A	N/A	N/A	N/A
NSPS social competence	56.87 (23.71)^h	32.46 (21.31)^h	18.38 (8.56)	14.56 (4.02)	N/A	N/A	N/A	N/A
NSPS signs of anxiety	42.68 (18.09)ⁱ	29.5 (17.41)ⁱ	13.15 (6.28)^j	9.75 (2.79)^j	N/A	N/A	N/A	N/A
NSPS physical appearance	23.03 (13.53)	18.0 (13.27)	14.17 (6.28)	11.69 (6.93)	N/A	N/A	N/A	N/A

Note. NSPS = Negative Self-Portrait Scale (modified to assess characteristics of images).

Bold values indicate significant ($p < .05$) or marginally significant ($p < .10$) effects of independent-samples t -tests.

^a $t(54) = 1.79$, $p = .08$.

^b $t(55) = 1.96$, $p = .06$.

^c $t(55) = 1.97$, $p = .05$.

^d $t(55) = 1.93$, $p = .06$.

^e $t(55) = 2.04$, $p = .05$.

^f $t(55) = 2.35$, $p = .02$.

^g $t(53) = 3.53$, $p = .001$.

^h $t(55) = 2.04$, $p = .05$.

ⁱ $t(55) = 2.79$, $p = .007$.

^j $t(27) = 1.95$, $p = .06$.

^k $t(40) = 1.73$, $p = .09$.

^l $t(14) = 3.04$, $p = .009$.

For negative memories, high relative to low SA participants reported marginally greater influence of their memories on their views of the world, $t(40) = 1.73$, $p = .09$, but no other comparisons were statistically or marginally significant (all $ps > .10$). Finally, for positive memories, only one group comparison was significant, with high SA participants significantly more likely than low SA participants to view them from a field rather than observer perspective, $t(14) = 3.04$, $p = .009$. However, this finding and the non-significant differences across the other comparisons within this category are difficult to interpret due to the low base rates of positive memory endorsement across the high and low SA groups ($n = 6$ and 10 , respectively).

Planned group comparisons were also conducted on the modified NSPS total scores and subscale scores associated with negative and positive images separately. Results demonstrated that the negative images of high relative to low SA participants were imbued with significantly higher levels of negative self-attribute characteristics overall, $t(53) = 3.53$, $p = .001$, and this effect was driven specifically by group differences in negative self-attribute characteristics associated with social competence concerns, $t(55) = 2.04$, $p = .05$, and concerns about signs of anxiety, $t(55) = 2.79$, $p = .007$, but not physical appearance concerns ($p > .10$). Finally, positive images of high relative to low SA participants also contained marginally more negative self-attribute characteristics associated with concerns about signs of anxiety, $t(27) = 1.95$, $p = .06$. No other modified NSPS subscales were associated with significant or marginally significant group differences for positive images (all $ps > .10$).

Coded properties of image and memory narratives

As depicted in Table 7, planned group comparisons of total episodic internal narrative details were conducted for negative images, negative memories, positive images, and positive memories for the *recall* and *specific probe* conditions separately. No group differences emerged in the *recall* condition. However, there was

Table 7

Total episodic and non-episodic details within coded image and memory narratives during “recall” and “specific probe” in high vs. low SA participants.

	Recall			Specific probe		
	High SA	Low SA	<i>t</i> -Test	High SA	Low SA	<i>t</i> -Test
DV: total episodic internal details						
Negative images – <i>M</i> (<i>SD</i>)	15.45 (9.02)	17.76 (11.89)	<i>t</i> (54) ^a = .83	33.06 (15.70)	40.92 (26.0)	<i>t</i> (54) ^a = 1.36
Negative memories – <i>M</i> (<i>SD</i>)	18.90 (10.32)	24.37 (14.81)	<i>t</i> (40) ^b = 1.42	40.22 (16.94)	46.84 (29.22)	<i>t</i> (40) ^b = .92
Positive images – <i>M</i> (<i>SD</i>)	13.27 (10.57)	17.13 (6.61)	<i>t</i> (28) ^c = 1.20	25.47 (12.44)	46.33 (31.40)	<i>t</i>(28)^c = 2.39*
Positive memories – <i>M</i> (<i>SD</i>)	16.17 (10.91)	21.80 (10.87)	<i>t</i> (14) ^d = 1.00	30.33 (12.29)	47.20 (29.08)	<i>t</i> (14) ^d = 1.34
DV: total non-episodic details						
Negative images – <i>M</i> (<i>SD</i>)	2.81 (5.56)	3.64 (6.13)	<i>t</i> (54) ^a = .53	6.58 (7.49)	9.36 (13.91)	<i>t</i> (54) ^a = .96
Negative memories – <i>M</i> (<i>SD</i>)	7.70 (7.84)	7.21 (8.43)	<i>t</i> (40) ^b = .19	9.82 (8.85)	17.32 (17.97)	<i>t</i>(40)^b = 1.76†
Positive images – <i>M</i> (<i>SD</i>)	4.67 (8.44)	2.67 (6.61)	<i>t</i> (28) ^c = .81	4.53 (5.78)	5.93 (6.59)	<i>t</i> (28) ^c = .61
Positive memories – <i>M</i> (<i>SD</i>)	5.17 (7.11)	7.80 (7.91)	<i>t</i> (14) ^d = .67	12.00 (14.13)	11.60 (9.19)	<i>t</i> (14) ^d = .07

**p* = .02; †*p* = .09.^a *n* (High SA = 31; low SA = 25).^b *n* (High SA = 23; low SA = 19).^c *n* (High SA = 15; low SA = 16).^d *n* (High SA = 6; low SA = 10).

a significant group difference in the total number of episodic details within positive image narratives during *specific probe*. Specifically, significantly fewer episodic details were coded in the narratives of high relative to low SA participants, $t(28) = 2.39$, $p = .02$. No other differences emerged, although group means associated with episodic details coded in participants' positive memories did trend in the same direction as those associated with positive images (as shown in Table 7), but this group comparison was underpowered due to the low base rates of positive memory endorsement across the high and low SA groups ($n = 6$ and 10 , respectively).

To determine whether the significant effect described above was specific to episodic details, we conducted the same set of group comparisons with total non-episodic details as the dependent variable. As shown in Table 7, the deficit observed in the total number of episodic details during *specific probe* among high SA participants for positive image narratives did not extend to non-episodic details. The only group effect in this set of analyses was a marginally significant one, with a greater number of non-episodic details coded in the negative memory narratives of low relative to high SA participants during *specific probe*, $t(40) = 1.76$, $p = .09$.

Correlations between symptoms and total episodic details

Collapsing across groups, bivariate correlations were calculated between participants' SPIN and BDI-II total scores, on one hand, and the number of episodic details produced during specific probe in participants' negative and positive image and memory narratives, on the other. Results revealed significant or marginally significant negative correlations between both types of symptoms and positive episodic image and memory details but non-significant correlations between symptoms and negative image and memory details, as shown in Table 8.

Table 8

Bivariate correlations between social anxiety and depression symptoms on the day of testing and total episodic details in image and memory narratives collapsed across groups.

Total episodic details (during specific probe)	SPIN		BDI-II	
	<i>n</i>	<i>r</i>	<i>n</i>	<i>r</i>
Negative images	55	-.13	44	-.03
Positive images	30	-.40*	24	-.44*
Negative memories	41	-.17	32	-.08
Positive memories	16	-.46†	14	-.61*

Note. SPIN = Social Phobia Inventory; BDI-II = Beck Depression Inventory II; uneven sample size values resulted from missing data; * $p < .05$; † $p = .08$.

Discussion

In this study, we used the newly developed WIMI to examine the nature and accessibility of negative and positive social images and associated autobiographical memories in high and low SA participants. Contrary to Hackmann et al.'s (2000) findings that 100% of the SAD patients they interviewed endorsed experiencing negative images, with all but one of these further able to link such images to past autobiographical experiences, the results of the present study indicated that 76% of high SA (and 64% of low SA) participants endorsed experiencing negative images. Of those with negative images, 74% of high SA participants (56% of all high SA participants) endorsed having associated negative autobiographical memories, relative to 76% of low SA participants (49% of all low SA participants). Although our findings require replication in clinical samples, the differences in endorsement rates of images and memories among socially anxious individuals between our study, which used the WIMI, and previous studies, which used other interview measures, may be related to a variety of methodological factors, including differing characteristics of the participant samples, interview methods, interviewer knowledge and behavior, and so on, as described in the Introduction, above. As the results of future studies accumulate, it is likely that a reliable estimate of the proportion of socially anxious individuals who experience images and associated autobiographical memories will be determined.

Both high and low SA participants were likely to endorse rather than deny being able to retrieve negative images and deny rather than endorse being able to retrieve positive images, but the proportion of endorsed relative to denied negative vs. positive images was more extreme in the high SA group. This finding suggests that while both groups may frequently bring negative images to mind in anxiety-provoking social situations, low SA individuals may have an easier time than high SA individuals also recalling positive images to balance out their negative ones. Consistent with this interpretation but with regard to memories, low SA participants were more likely to endorse rather than deny being able to retrieve specific positive autobiographical memories that were linked to their positive images, whereas high SA participants were more likely to deny rather than endorse being able to retrieve specific positive memories that were associated with their positive images.

Furthermore, the properties of endorsed negative and positive images differed in several important ways between the two groups. High SA individuals reported that their negative images were associated with more negative and less positive affect during

retrieval, contained more negative self-related themes, and had a greater influence on their views of self, others, and the world. This finding suggests, importantly, that even if the frequency of experiencing negative images does not distinguish high SA individuals from their low SA counterparts, the psychological impact associated with such images clearly does.

Moreover, contrary to hypotheses, high SA participants reported that their negative images were less vivid than low SA participants, and they were no more likely than low SA participants to report that their images were intrusive. Even more surprising, high SA individuals were also no more likely to retrieve negative images from the observer rather than field perspective – a finding that is at odds with previous studies of socially anxious individuals (e.g., D'Argembeau et al., 2006; Hackmann et al., 1998; see also Wild et al., 2008). Before jumping to any firm conclusions, future research using the WIMI (in comparison with other interview methods) is required to replicate these results, determine the extent to which reported vividness, intrusiveness, and retrieval perspective are interrelated phenomena, and, of course, to identify and understand the contexts in which social anxiety might moderate these outcomes.

Finally, high SA participants provided positive image narratives that were significantly impoverished in episodic detail relative to those of low SA participants, despite extensive interviewer probing designed to encourage them to provide detailed accounts. This is the first evidence to our knowledge of such deficits in social anxiety. Correlational analyses indicated that the number of retrieved positive episodic details in participants' images and memories decreased as their level of social anxiety increased, but also as their depression symptoms increased. In contrast, the number of negative episodic details in participants' image and memory narratives was not significantly correlated with either symptoms of SA or symptoms of depression. Future studies are needed to replicate these findings and to disentangle the relative contributions of social anxiety and depression symptoms in obstructing the retrieval of positive episodic details in image and memory narratives, as discussed further below.

In sum, this pattern of results suggest that high vs. low SA individuals differ in at least three important ways with respect to their autobiographical recollections of social images and events: first, in the relative proportion of retrievable negative vs. positive images and memories, with high SA individuals endorsing a more extreme, unbalanced ratio of negative relative to positive images and memories in comparison to low SA individuals; second, in the nature of the subjective experience of bringing negative images to mind, which high SA individuals generally reported as being more negatively impactful across a number of cognitive and emotional indicators; and third, in the nature of episodic detail encoded in participants' positive images, which was significantly impoverished in high relative to low SA participants.

Taken together, the results both complement and extend psychological models of emotional disorders, that have emphasized the role of negative biases in information processing (e.g., Gotlib et al., 2004; Hirsch & Clark, 2004) and dysfunctional emotion regulation strategies (e.g., Gross, 2007; Joormann & Gotlib, 2010; Moses & Barlow, 2006) in the maintenance of symptoms. Studies have shown that relative to controls, patients with affective psychopathology have difficulty inhibiting the mental processing of negative material (e.g., Joormann & Gotlib, 2010), are more likely to ruminate in response to negative events and the conscious recollection of negative autobiographical experiences (e.g., Kross, Davidson, Weber, & Ochsner, 2009), and are more likely to suppress rather than reappraise the expression of negative emotions (e.g., Campbell-Sills, Barlow, Brown, & Hofmann, 2006a, 2006b). Given these previous findings, it is not surprising that high SA individuals in the present study reported experiencing

negative images that were associated with more negative cognitive and emotional consequences than their low SA counterparts. of more negative consequences as a result of having negative images comes to mind. Although we did not measure whether high SA individuals tend to respond to their distressing images by attempting to suppress them, it is likely that they do, given what we know about emotion regulation in affective psychopathology. It is also possible, therefore, that attempts to suppress intrusive and well-elaborated, but unwanted, negative images and memories (see Anderson et al., 2004) may also lead, unintentionally, to the suppression of less elaborated and more fragile positive ones, thus producing degraded recollections.

Truncated memory search has been proposed to account for the overgeneral memory effects observed in previous studies of depressed and traumatized samples using the AMT (see Williams et al., 2007). As in those previous investigations, the present study also detected impoverished episodic detail in the narratives of anxious participants. However, these impoverishments occurred only for positive recollections and were, therefore, unlikely to have been caused by a defective general mechanism such as suppression or truncated memory search. Indeed, the ratio of episodic to non-episodic details in negative memories examined during specific probe in the present study was about 1.5 higher in high relative to low SA individuals ($40.22/9.82 = 4.1$ vs. $46.84/17.32 = 2.7$), suggesting that high SA participants' negative memories were actually *more* episodically-specific, in contrast to expected findings if suppression or truncated memory search were the operating mechanisms.

Alternatively, therefore, we propose the more parsimonious explanation that impoverished retrieval of episodic details in the positive image narratives of high SA participants may be related to their frequency of rehearsal. Quite simply, it is likely that high SA individuals infrequently bring positive social recollections to mind, which, in turn, leads to a degraded memory trace (see Moscovitch, 2008), which cannot be made more accessible or elaborate by extensive specific probing. Thus, our findings suggest that effective emotion regulation in social anxiety may depend not only on being able to offset negative self-referential images and memories by reappraising them as non-threatening when they enter one's conscious awareness, but also on being able to bring positive images and memories to mind and rehearse them effectively.

This study was limited in a number of ways. First, as was already mentioned, the study was conducted using an analog sample of socially anxious university students and it will be important to replicate these findings in clinical samples. Also, it would have been informative to have included a control group of participants with symptoms of high negative affect (and low social anxiety) in order to examine whether the differences between groups in the present study were due to differences in social anxiety per se, or, simply, to differences in high trait negative affect. Indeed, our correlational analyses indicated that the number of episodic details produced in participants' narratives of positive images and memories was significantly associated not only with symptoms of social anxiety but also with symptoms of depression. Given these correlational findings and the well-established methodological problems (see Miller & Chapman, 2001) associated with controlling for, or covarying out, factors that co-occur in nature (i.e., non-randomly) with the independent variable of interest (as is the case with symptoms of depression and social anxiety; Brown, Campbell, Lehman, Grisham, & Mancill, 2001), it is impossible to determine the extent to which our results were driven by symptoms of social anxiety, symptoms of depression, or an interactive combination of the two. Future studies should enrol a depression-only control group, to the extent that recruitment of such a group is both possible and desirable. Interestingly, the observed differences between high and low SA

individuals in their subjective experiences of bringing negative images to mind in the present study are reminiscent of similar data emerging from studies examining differences between depressed and non-depressed individuals in their experiences of bringing autobiographical memories to mind (see Newby & Moulds, 2011), thus suggesting that high levels of negative affect might represent a common mediator of such experiences. Another limitation was the relatively small sample size of some cells across groups and conditions as a result of low endorsement rates of particular categories (e.g., positive memories). Moreover, the data collected on participants' images and memories both in the present study and in past studies in this area of research rely, by necessity, on the subjective insight, recall, and honesty of the participants themselves and hence results may be influenced by a wide variety of factors, including individual differences in recollection confidence, unspoken personal criteria for reporting images and memories, and embellishment of narrative details, among others. Finally, participants were asked to report on the mental images they typically experience in threatening and comfortable social situations, but the frequency and nature of mental images that may arise during actual social situations is still unknown.

In future studies, the WIMI might be used to enhance our understanding of why emotional disorders persist and how to treat them more effectively. Efficacious outcomes in exposure-based CBT for SAD and other emotional disorders are thought to be mediated by inhibitory learning processes, which promote therapeutic changes in the salience and retrievability of positive vs. negative mental representations of self (Craske et al., 2008; Foa & Kozak, 1986; Foa & McNally, 1996; see also Moscovitch, Antony, & Swinson, 2009, for a comprehensive review). For example, Brewin (2006) hypothesized, in his *retrieval competition account*, that CBT does not promote symptom change by directly modifying negative self-representations per se, but rather works by strengthening positive self-representations in memory and helping them win the retrieval competition over negative representations that were predominantly accessible prior to therapy. Though compelling, Brewin's theory has not yet been rigorously tested in socially anxious samples. Emotional disorders such as SAD, in which patients chronically retrieve negative self-representations in lieu of positive ones, may be characterized either by the complete absence of positive self-representations or by impaired accessibility leading to impoverished representations. Thus, the WIMI could be used to help disentangle these possibilities and, potentially in future studies, to investigate whether CBT plays an important role either in helping patients create new positive self-representations that are subsequently encoded in memory and later retrieved, or in enhancing the salience of old positive representations that were previously stored in memory but had become inaccessible. As a result of undergoing efficacious exposure-based CBT, patients with SAD ought to experience more rewarding and positive social events, develop a larger, more accessible mental storehouse of positive images, and learn how to practice retrieving, reviewing, and rehearsing a greater number of supporting positive autobiographical memories. They should also, of course, learn to cope more adaptively with negative autobiographical recollections that do come to mind by actively reinterpreting their meaning in a manner that decreases their emotional salience and cognitive impact.

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