



Updating the emotional content of working memory in social anxiety



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ABSTRACT

Background and objectives: Cognitive accounts suggest that information processing biases have an important role in the etiology and maintenance of social anxiety (SA). Empirical evidence support this notion has been established in variety of cognitive domains. Yet, it is still not known how social anxious individuals process emotional content in working memory (WM). Maladaptive WM updating may influence emotion regulation and anxiety during social situations in SA. Thus, the aim of the present study was to explore biases when updating emotional content in SA.

Methods: 31 participants with high SA and 34 control participants performed an emotional 2-back task. Biases were assessed by intrusion cost in reaction times, which reflects the conflict between the inhibition of irrelevant content and the activation of relevant content.

Results: Results revealed a diminished intrusion cost in reaction times for irrelevant positive content in the high, but not in the low SA group. No differences were found for negative or neutral content.

Limitations: In the present study we used an analogue sample of students with high SA rather than a true clinical sample. Further research is needed to examine WM updating in clinical population.

Conclusions: These findings suggest that individuals with SA are better at inhibiting irrelevant positive information, a maladaptive cognitive bias that may prevent positive feedback from entering the cognitive system. This cognitive bias in WM may play a role in the etiology and maintenance of SA.

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1. Introduction

Social anxiety disorder (SAD) is characterized by intense fear or anxiety of situations that involve social interactions, social performance, or evaluation by others (American Psychiatric Association, 2013). SAD is a common anxiety disorder, with lifetime and 12-month prevalence of 12.1% and 7.1%, respectively (Kessler, Berglund, et al., 2005; Kessler, Chiu, Demler, Merikangas, & Walters, 2005). Cognitive accounts suggest that information processing biases constitute one of the main factors underlying social anxiety (SA) symptoms (e.g., Beck, Emery, & Greenberg, 1985; Clark & Wells, 1995; Rapee & Heimberg, 1997; Trower & Gilbert, 1989).

1.1. Information processing in social anxiety

Cognitive models suggest that when processing social information, individuals with SA notice and remember external social cues in an extensively negative fashion, leading them to perceive socially-neutral situations as threatening and hostile. Furthermore, they tend to neglect positive social information, resulting in enhanced anxiety, avoidance and safety behaviors, ultimately perpetuating symptom maintenance. Clark and Wells (1995) suggested that when exposed to social situations, individuals with SA shift their attention to internal markers (such as thoughts, feelings and body sensations) to construct a negative evaluation of how they are being perceived by others. This distorted impression contributes to extend and preserve anxiety. The view that cognitive biases affecting processing of internal and external information has been established in a variety of empirical studies in different domains such as attention, interpretation and memory.

1.1.1. Attentional biases in social anxiety

Previous studies have shown that individuals with SA selectively attended toward socially threatening information more than

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control participants (e.g., Asmundson & Stein, 1994; Mogg, Philippot, & Bradley, 2004). Moreover, individuals with SA were impaired in disengaging their attention away from socially threatening information to other stimuli (Amir, Elias, Klumpp, & Przeworski, 2003).

In addition, a growing body of research shows that SA is also characterized by a reduced attention to positive social cues. For example, socially anxious individuals recognized positive facial expressions slower than non-anxious individuals (e.g., Perowne & Mansell, 2002; Silvia, Allan, Beauchamp, Maschauer, & Workman, 2006). Similarly, an eye movement study demonstrated that socially anxious individuals disengaged their attention more quickly away from positive stimuli than controls (Chen, Clarke, MacLeod, & Guastella, 2012).

1.1.2. Interpretation biases in social anxiety

After external information captures our attention, it undergoes higher level processing, such as evaluation and interpretation. Studies of interpretation biases demonstrated that individuals with SA tended to interpret ambiguous social cues more negatively and to exaggerate the consequences of mildly negative social events (Amir, Foa, & Coles, 1998; Stopa & Clark, 2000). In addition, they interpreted positive social outcomes in a negative manner that exacerbates negative predictions for future social interactions (Alden, Taylor, Mellings, & Laposa, 2008).

1.1.3. Memory biases in social anxiety

Interpretation biases and attentional biases may affect the activation of representations in memory, resulting in biases of encoding, elaboration and retrieval. However, results of memory biases in SA are inconsistent (see Heinrichs & Hofmann, 2001; Hirsch & Clark, 2004; Musa & Lépine, 2000). Although several studies showed that high socially anxious participants demonstrate bias memory toward negative information (Coles & Heimberg, 2005; Lundh & Öst, 1996), such a bias was not found in most studies in the field (e.g., Becker, Roth, Andrich, & Margraf, 1999; Cloitre, Cancienne, Heimberg, Holt, & Liebowitz, 1995; Rapee, McCallum, Melville, Ravenscroft, & Rodney, 1994; Sanz, 1996; Wenzel & Holt, 2002). One explanation for these mixed results is that selective processing of social information depends on specific memory mechanisms, so the term “memory bias” may be general and misleading. Specifically, explicit and implicit memory processes may affect information processes differentially (Coles & Heimberg, 2002). Additionally, it is important to distinguish between processes of encoding and retrieval that may contribute differently to memory biases. Hence, memory biases should be explored more specifically, considering various memory processes.

Amir et al. (1998), suggest a dual-model account for information processing in SA that reconciles the aforementioned mixed findings. This model separates between automatic and strategic stages of information processing. On the one hand, attention is automatic and effortless, and reflects hypervigilance to threat, resulting in increased activation of negative social representations. On the other hand, high-level processes, such as retrieval from memory, reflect avoidance strategies to threat, resulting in reduced activation of negative social representations. Thus, the vigilance-avoidance model can potentially explain memory biases as reflecting a distinct deficit in SA that is not explained by attentional biases.

1.2. Working memory and social anxiety

In order to understand the specific information-processing deficits in SA, it is important to target the processes that lead to cognitive biases in SA. Keeping this in mind, the present study

investigated working memory (WM) as a construct that bridges between perception and attention on the one hand, and long-term memory on the other, as will be elaborated below.

WM is the cognitive system that serves for temporarily maintenance of task-relevant information (Baddeley & Hitch, 1974; Miyake & Shah, 1999). During every conscious moment we are exposed to large amounts of information, including emotional content, but only a limited amount of information is actually accessible for further processing. This problem stems from the severe capacity limitation of WM, being around 3–4 item (Cowan, 2001; Luck & Vogel, 1997). This limitation emphasizes the need for selectively attending relevant information in order to utilize the limited capacity efficiently (Vogel, McCollough, & Machizawa, 2005). The ability to selectively update WM with task-relevant information enables exploiting the most relevant information for high level cognitive functioning, such as goal-directed behavior and problem solving.

Indeed, several studies explored the relationship between WM and SA. For example, Moriya and Sugiura (2012) examined visual WM capacity in a change detection task with neutral stimuli. WM capacity was positively related to trait SA. Moreover, under inhibition demands, trait SA predicted a decrease in WM capacity. In a different study, Amir and Bomyea (2011) used an operation span task with threat-vs. non-threat-related words. With non-threatening words, SAD individuals demonstrated a lower WM capacity compared to non anxious controls. However, for threat-related words, enhanced WM capacity was observed in SAD individuals. The findings of these two studies are conflicting regarding the effect of neutral stimuli on WM capacity in SA, and more research needs to be carried out toward understanding the phenomenon.

While WM capacity relates to the “static” aspects of WM, namely the amount of maintained information, recent research focused on the dynamic process of WM updating. The ability to selectively update goal-relevant information in WM plays an important role in emotion regulation, as well as in psychopathology (e.g., Levens & Gotlib, 2010). Studying WM updating, rather than capacity per se, is important for at least. First, WM updating plays a key role in goal-directed behavior and high-level cognitive tasks. As such, it might serve to explain between-group differences in these abilities. Second, between-group differences in WM capacity may not reflect a primary etiology, but rather may be the consequence of differences in updating ability. Arguably, deficits in WM capacity may stem from impaired ability to update new information or remove outdated one, rather than from poorer maintenance. To date, no research has examined the processes involved in WM updating with emotional content in socially anxious individuals. This is the goal of the present study.

1.2.1. Working memory updating

WM updating is a complex ability that is composed of several sub-processes that operate in concert to ensure that task-relevant representations enter WM, while irrelevant information is filtered out or discarded (Ecker, Lewandowsky, Oberauer, & Chee, 2010; Kessler & Meiran, 2006, 2008; Kessler & Oberauer, 2014). This is achieved by both input selection, namely focusing on the relevant information while filtering out irrelevant one (Engle, Tuholski, Laughlin, & Conway, 1999; Kane & Engle, 2003), and removing previously-relevant information when it becomes outdated, presumably through inhibitory processes (e.g., Hasher, Zacks, & May, 1999; Oberauer & Kliegl, 2001).

1.2.2. Working memory updating and psychopathology

Individual differences in WM updating are correlated with intelligence, age, and psychopathology (Friedman et al., 2006; Levens

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