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Revisiting attentional processing of non-emotional cues in social anxiety: A specific impairment for the orienting network of attention

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ABSTRACT

People with social anxiety disorder (SAD) exhibit an attentional bias for threat (AB). Nevertheless, the focus on AB for emotional stimuli has led to neglect the exploration of basic attention deficits for non-emotional material among SAD patients. This study aimed to investigate the integrity of the attentional system in SAD. The Attention Network Test was used to precisely explore attentional deficits, and centrally the differential deficit across the three attentional networks, namely *alerting* (allowing to achieve and maintain a state of alertness), *orienting* (allowing to select information from sensory input by engaging or disengaging attention to one stimulus among others and/or shifting the attentional resources from one stimulation to another), and *executive control* (involving the top-down control of attention and allowing to resolve response conflicts). Twenty-five patients with SAD were compared to 25 matched controls. SAD patients exhibited a specific impairment for the orienting network ($p < 0.001$) but preserved performance for the alerting and executive networks. Complementary analyses revealed that this impairment may result from a faster attentional engagement to task-irrelevant material. The orienting impairment was highly correlated with the intensity of the social anxiety symptoms, but did not correlate either with trait-anxiety, state-anxiety, or depressive symptoms.

1. Introduction

It is now well established that individuals with social anxiety disorder (SAD), when compared to nonanxious controls, consistently demonstrate an attentional bias (AB) for threatening cues (e.g., facial expression of anger or disgust; Amir et al., 2003; Mogg et al., 2004). Cognitive theorists have argued that AB may be causally implicated in the maintenance, and perhaps in the etiology, of SAD (Clark and Wells, 1995; Rapee and Heimberg, 1997; for a review, see Morrison and Heimberg (2013)). Accordingly, it has been evidenced that reducing AB (through attention bias modification procedures) alleviates SAD symptoms (e.g., Amir et al., 2009; De Voogd et al., 2014; Heeren et al., 2012). Moreover, recent findings also suggested that experimentally inducing an AB towards threat among healthy volunteers increases SAD symptoms (Heeren et al., 2012).

These research advances to date have generated far-reaching interest in AB for SAD within the scientific and practitioners community. Nevertheless, although several cognitive theorists have suggested that AB might be the consequence of a reduced general ability to control the allocation of attention (for a review, see Heeren et al. (2013)), the focus on AB for emotional stimuli has led to neglect the empirical exploration of basic attention deficits for non-emotional material. Consequently, it has hampered the accumulation of comprehensive evidence regarding the attentional abilities among SAD patients. In particular, the hypothesis that the AB observed in SAD might not be specific to disorder-related stimuli but might rather result from more global attentional impairments has not yet been tested. Clarifying these basic mechanisms involved in AB is critical as this latter has been widely considered as a key process in the maintenance of SAD.

General attentional abilities have been little studied in SAD. First, an eye-tracking study has shown that the attentional difficulties presented by SAD individuals when processing emotional faces are independent of the threatening valence of the stimuli (Wieser et al., 2009). Second, electrophysiological studies (Peschard et al., 2013; Rossignol et al., 2012) have shown that SAD is associated with a general deficit in the ability to regulate the attentional allocation towards emotional as well as non-emotional material (i.e. neutral faces or objects). Finally, very few studies have been conducted regarding the attentional deficits in SAD by means of usual neuropsychological

Abbreviations: AB, Attentional bias; ANT, Attention Network Task; BDI, Beck Depression Inventory; CP, control participants; LSAS, Liebowitz Social Anxiety Scale; MINI, Mini Neuropsychiatric Interview; RT, reaction time; SAD, social anxiety disorder; STAI, State and Trait Anxiety Inventory

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assessment. Their outcomes led to mixed conclusions: some studies have shown preserved abilities on several common tasks assessing attentional and executive abilities (i.e., Sutterby and Bedwell, 2012) while others have described altered performance on tasks assessing selective attention (O'Toole and Pederson, 2011), and altered performance on tasks targeting the executive control of attention (i.e., Judah et al., 2013).

A possible explanation for these discrepancies is that previous studies only used isolated tasks focusing on specific sub-components. Consequently, they were unable to precisely compare the impairments across the different sub-components of the attentional system. A more systematic exploration of attentional system is thus clearly needed and should be based on a unified task offering a differential evaluation of each attentional sub-component. The Attention Network Test (ANT; Fan et al., 2002), based on a recent and validated model of attention (Petersen and Posner, 2012; Posner and Rothbart, 2007), constitutes an adapted tool for this purpose. This task, combining Posner's cueing task (Posner, 1980) and the Flanker task (Eriksen and Eriksen, 1974), efficiently evaluates the three independent attentional networks identified in the model (thus allowing a direct comparison between components in a unified task), namely (1) the *alerting network*, allowing to achieve and maintain a state of alertness, i.e. high sensitivity or readiness to react to incoming stimulation; (2) the *orienting network*, allowing to select information from sensory input by engaging or disengaging attention to one stimulus among others and/or shifting the attentional resources from one stimulation to another; (3) the *executive control network*, involving the top-down control of attention and allowing to resolve response conflicts.

Regarding the metric properties of the ANT, MacLeod et al. (2010) noted several positive features concerning its validity. First, the ANT is based on flanker and cued RT tasks which are well-established in attention research. Second, behavioral studies indicate independence of the ANT scores. Finally, neuroimaging studies reinforced the validity of this task by showing distinct cerebral activations related to each network, i.e. superior temporal and thalamic activations for alerting, superior parietal lobule and temporal fusiform gyrus activations for orienting, thalamic and superior–inferior frontal activations for executive control (Fan et al., 2005). The ANT thus constitutes a powerful and theoretically grounded task to explore attentional components.

Recently, Pacheco-Unguetti et al. (2011) provided the first experimental evidence of attentional impairments among individuals suffering from anxiety disorders using the ANT. In this study, a sample of patients suffering from either generalized anxiety disorder, panic disorder, posttraumatic stress disorder, or obsessive–compulsive disorder were compared to a matched healthy comparison group. While anxious patients exhibited preserved alerting and orienting networks, they evidenced impairments in the executive network. However, despite its potential for bringing new insights concerning attentional deficits in SAD, this task has surprisingly not yet been used among SAD individuals. Given that this study is the first in its kind, several hypotheses can be formulated. Because Moriya and Tanno (2009) reported a negative correlation between orienting network performance and the fear of negative evaluation among healthy volunteers, one possibility is that SAD patients exhibit an impaired orienting network. Alternatively, following the study of Pacheco-Unguetti et al. (2011), SAD individuals may exhibit a selective impairment for the executive network. Finally, because two recent studies reported improvement in the alerting and executive networks among SAD patients following an attention bias modification procedure (Heeren et al., 2015; McNally et al., 2013), one may wonder whether SAD individuals may show impairments for both alerting and executive networks. Hence, the main aim of our study was thus investigate this issue among a selected sample of individuals with SAD.

2. Method

2.1. Participants

The SAD participants were recruited via notices posted in public places and in the waiting room of private practitioners in the Louvain-la-Neuve area. The study was presented as an experiment on basic attention mechanisms underlying social anxiety. Volunteers who had expressed an interest in the study were administered the French version of Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987; for validation of the French version, see Heeren et al., 2012), a self-report questionnaire assessing symptoms of SAD. To confirm the presence of SAD, we administered the social anxiety section of the Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998), a structured interview assessing specific DSM-IV axis I disorders. One assessor administered the MINI to all participants. He had a postgraduate clinical training certification and over 4 y of clinical training, including 1 y of intensive training on using the MINI to make reliable diagnoses. Participants eligible for the SAD group were then selected, with the following inclusion criteria (a) being between 18 and 60 years old, (b) having a total score above 60 on the LSAS (based on the cut-off for SAD for the French version), (c) having a diagnosis of SAD at the MINI, (d) having normal or corrected-to-normal vision. Moreover, participants were not included in the study if they presented: (a) current substance abuse or dependence, (b) current/history of neurological problems, (c) current psychotropic medications.

The SAD group (SAD) consisted in 25 participants (19 women) aged between 19 to 59 years old (M=47.68, S.D.=12.93). SAD participants were matched for age ($\pm$2 y), gender, and education level with 25 paired control participants (CP) who were free of SAD symptoms (assessed using the MINI) and of any history of psychiatric and neurological disorder (verbally assessed). CP were recruited through the volunteer pool of the Université Catholique de Louvain (Belgium). Education level was assessed according to the number of years of education completed since starting primary school. Participants were paid 5 euros for their participation. Their demographic characteristics appear in Table 1.

2.2. Materials and measurements

2.2.1. Control measures

Complementarily to the screening measurements, validated self-completion questionnaires were used to assess depression (Beck Depression Inventory 2nd Edition, BDI; Beck et al., 1996) and state- and trait-anxiety (State and Trait Anxiety Inventory; STAI; Spielberger et al., 1983). In the present experiment, the validated

Table 1
Demographic and clinical measures for individuals with social anxiety disorder (SAD) and matched control participants (CP): mean (S.D.).

	SAD (N=25)	CP (N=25)	t or χ^2	p
Demographic measures				
Age	47.28 (12.93)	48.08 (12.78)	0.32[a]	0.75
Gender ratio (male/female)	6/19	6/19	0.01 [b]	0.99
Educational level (in years)	15.16 (2.30)	15.56 (2.58)	0.58[a]	0.56
Clinical measures				
Beck Depression Inventory (BDI)	14.04 (7.50)	4.40 (4.74)	5.43[a]	< 0.01
State and Trait Anxiety Inventory-Trait (STAI-T)	40.52 (7.08)	32.68 (10.04)	3.19[a]	< 0.01
State and Trait Anxiety Inventory-State (STAI-S)	51.72 (2.93)	50.23 (3.61)	0.77[a]	0.44
Liebowitz Social Anxiety Scale (LSAS)	77.88 (13.11)	27.04 (15.63)	12.46[a]	< 0.01

[a] Value for $t(48)$.
[b] Value for $\chi^2(1, N=50)$.