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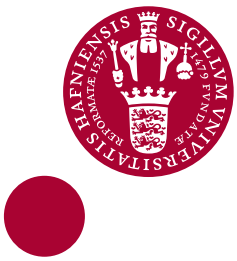

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Engagement and disengagement components of attentional bias to emotional stimuli in anxiety and depression

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Abstract

Previous research shows that attentional bias is associated with emotional difficulties. The aim of the present study was to investigate the engagement and disengagement components of attentional bias to emotional stimuli in anxiety and depression using the attentional assessment task. The experimental groups consisted of 54 clinical participants in treatment for anxiety or depression and 54 control participants. The results indicated that the clinical participants showed greater levels of attentional avoidance of emotional stimuli than the control participants. Additional subgroup analyses suggested that this effect may be limited to symptoms of anxiety and not symptoms of depression. Results are discussed in relation to current models of information processing in emotional disorders.

Keywords

Anxiety, attentional bias, depression, disengagement, emotional stimuli, engagement

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Introduction

Cognitive models state that selective attention plays a key role in the development and maintenance of emotional disorders and that attentional biases in the processing of emotional stimuli are theoretically and empirically associated with emotional difficulties (e.g., Beck, 1976; Williams et al., 1988). According to Posner and Petersen (1990), spatially selective attention involves three components: engagement, disengagement, and shifting. Engagement is the beginning of preferential processing, disengagement is the end of preferential processing, and shifting is the movement of attention. In relation to models of attentional bias, faster engagement is often referred to as enhanced engagement, slower disengagement is referred to as delayed disengagement, and faster disengagement is referred to as attentional avoidance.

Cisler and Koster (2010) have proposed a model of attentional bias in anxiety. The model suggests that (i) a threat detection mechanism mediates the association between enhanced engagement and anxiety, (ii) attentional control mediates the association between delayed disengagement and anxiety, and (iii) emotion regulation mediates the association between attentional avoidance and anxiety. Similarly, Koster et al. (2011) have proposed an impaired disengagement hypothesis in depression. The main idea of the impaired disengagement hypothesis is that prolonged processing of self-referential material is due to impaired attentional disengagement from negative self-referential information (Koster et al., 2011). Furthermore, a combined cognitive biases hypothesis has been proposed in both social anxiety (Hirsch et al., 2006) and depression (Everaert et al., 2012). The combined cognitive biases hypothesis suggests that cognitive biases (i.e., attention, interpretation, memory, cognitive control) do not operate in isolation, but rather can influence each other and that combinations of biases have greater impact on disorders than individual cognitive processes (Everaert et al., 2012; Hirsch et al., 2006).

Attentional bias in anxiety and depression has been studied extensively with a variety of attentional tasks. A meta-analysis by Bar-Haim et al. (2007) found evidence of threat-related attentional bias in anxiety in reaction time-based studies using the Stroop task (Stroop, 1935) and the visual probe task (MacLeod et al., 1986), but not the spatial cueing task (Posner, 1980). Similarly, a meta-analysis by Peckham et al. (2010) found evidence of attentional bias to negative stimuli in depression in reaction time-based studies using the visual probe task, but not the Stroop task. Furthermore, Armstrong and Olatunji (2012) conducted a meta-analysis based on eye-tracking measures. The meta-analysis revealed that anxious individuals showed vigilance for threat during free viewing and visual search and impaired disengagement from threat in visual search tasks, but not during free viewing. In contrast, depressed individuals showed increased maintenance of gaze on dysphoric stimuli during free viewing. Overall, the meta-analyses show evidence of attentional bias in both anxiety and depression. However, the results suggest low-to-medium effect sizes and discrepancy between different paradigms.

Attentional bias in anxiety and depression has mostly been studied using the modified Stroop task (Stroop, 1935) and the visual probe task (MacLeod et al., 1986). In the Stroop task, attentional bias is quantified as the latency to name the color of emotional stimuli relative to neutral stimuli. In the visual probe task, attentional bias is quantified as the latency to respond to a target probe in the location of emotional stimuli relative to the location of neutral stimuli. The engagement and disengagement components of attentional bias in anxiety and depression have mostly been studied using the spatial cueing task (Posner, 1980). In the spatial cueing task, engagement is quantified as the latency to respond to a target probe on trials where cue and target are in the same location, and disengagement is quantified as the latency to respond to a target probe on trials where cue and target are in different locations.

Eye-tracking methodology has also been used to study the engagement and disengagement components of attentional bias. For instance, excellent eye-tracking tasks have been developed by Sears et al. (2010) and Sanchez et al. (2013). The study by Sears et al. (2010) included dysphoric and non-dysphoric individuals. According to Sears et al. (2010), dysphoric individuals were slower to disengage their attention from depression-related images than non-dysphoric individuals. The study by Sanchez et al. (2013) included depressed and control participants. Similarly, Sanchez et al. (2013) found that depressed participants took significantly longer to disengage from depression-related stimuli than control participants.

Clarke et al. (2013) have criticized the current paradigms when it comes to investigating the engagement and disengagement components of attentional bias in anxiety. They posited the following three criteria which an experimental task should fulfill to effectively yield valid measures of biased attentional

engagement and disengagement (i) controlling for non-attentional behavioral freezing in the presence of threat, (ii) equivalently securing attention on a predetermined initial focus, and (iii) enabling assessment of the ease with which attention can then be shifted in relation to emotionally valenced information (Clarke et al., 2013). A problem with previous tasks is that when emotional and neutral stimuli are presented in separate trials, non-attentional behavioral freezing may account for response slowing effects (see Mogg et al., 2008). Also, to produce valid measures of engagement and disengagement it is vital to locate the starting point and the destination of the attentional shift.

In response to the critique by Clarke et al. (2013), the attentional assessment task was developed (Grafton et al., 2012). This task uses an *anchor probe* to secure attention on a predetermined initial focus and a *target probe* which must be matched with the anchor probe. Engagement is measured on trials where the anchor probe precedes non-emotional stimuli and the target probe follows emotional stimuli. Disengagement is measured on trials where the anchor probe precedes emotional stimuli and the target probe follows non-emotional stimuli. The advantage of the attentional assessment task is that (i) it controls for non-attentional behavioral freezing by presenting both emotional and neutral stimuli simultaneously, (ii) it equivalently secures attention on a predetermined initial focus using the anchor probe, and (iii) it enables assessment of attentional shifting using the target probe.

Several studies have used the attentional assessment task to study attentional mechanisms. For instance, a study by Grafton et al. (2012) included high and low affectivity participants. According to Grafton et al. (2012), higher negative affectivity was shown to be associated with both enhanced engagement to and delayed disengagement from negative stimuli, particularly when this was anxiety-related. In contrast, lower positive affectivity was associated with attentional avoidance of negative stimuli, particularly when this was depression-related (Grafton et al., 2012). Another study by Rudaizky et al. (2014) included high and low trait anxiety participants. According to Rudaizky et al. (2014), the results demonstrate that enhanced engagement and delayed disengagement from negative stimuli are both characteristic of elevated levels of anxiety vulnerability. Grafton and MacLeod (2014) replicated this in a similar setup and found that enhanced engagement and delayed disengagement from negative stimuli both characterize higher anxiety vulnerability.

Grafton and MacLeod (2016) also used the task with participants either high or low in social anxiety. Their results indicated that higher social anxiety vulnerability is characterized only by enhanced engagement to socially negative stimuli and not by delayed disengagement from these stimuli (Grafton & MacLeod, 2016). Furthermore, the attentional assessment task has been used to study attentional mechanisms in individuals high and low in ruminative disposition. One study was done by Grafton et al. (2016), who suggested that their findings show how heightened ruminative disposition is related only to delayed disengagement from depression-related stimuli and does not involve enhanced engagement to such stimuli. Southworth et al. (2017) replicated this in a similar setup, and their results indicated that elevated dispositional ruminative brooding is associated with delayed disengagement from negative compared to positive stimuli.

Overall, empirical studies using the attentional assessment task suggest that high negative affectivity and high trait anxiety are associated with enhanced engagement and delayed disengagement from negative stimuli. High social anxiety is associated with enhanced engagement to negative stimuli while, high ruminative disposition is associated with delayed disengagement from negative stimuli, and low positive affectivity is associated with attentional avoidance of negative stimuli. However, the studies using the attentional assessment task have only included subclinical samples. Recently, studies have challenged the assumption that results can be generalized from subclinical to clinical samples (Blicher & Reinholdt-Dunne, 2019; Yiend et al., 2015). Both studies suggest that clinically anxious participants show attentional avoidance of threat using the spatial cueing task, whereas most previous studies suggest that subclinical participants show delayed disengagement from threat using the spatial cueing task (e.g., Fox et al., 2001; Yiend & Mathews, 2001).

Ellenbogen and Schwartzman (2009) investigated engagement and disengagement to emotional stimuli in clinically anxious and clinically depressed participants using the spatial cueing task. According to Ellenbogen and Schwartzman (2009), information processing in anxious participants was characterized by early attentional selection of emotional stimuli, before full conscious awareness, followed by attentional avoidance of threat. In contrast, depressed

participants displayed delayed disengagement from dysphoria. However, the spatial cueing task used by Ellenbogen and Schwartzman (2009) does not fulfill the criteria for measuring engagement and disengagement suggested by Clarke et al. (2013), questioning the validity of the findings. Therefore, it is of the utmost importance to further investigate this directly in clinical samples.

Bearing this in mind, the present study used the attentional assessment task to investigate the engagement and disengagement components of attentional bias to emotional stimuli in clinically anxious and clinically depressed participants. Based on the results from the study by Ellenbogen and Schwartzman (2009), we hypothesized that high anxiety participants would show faster disengagement from threatening stimuli than control participants and that high depression participants would show slower disengagement from dysphoric stimuli than control participants.

Method

Participants

The total sample consisted of 108 participants. Both the clinical group ($M_{age} = 33.70$, $SD = 10.35$; 38 female, 70%) and the control group ($M_{age} = 30.22$, $SD = 7.20$; 28 female, 52%) contained 54 participants. The control participants were recruited using social media and were tested at the University of Copenhagen. The clinical participants were recruited and tested at the Psychotherapy Clinic at Copenhagen Mental Health Center, a public secondary outpatient service located in the capital of Denmark. For all patients referred to the Psychotherapy Clinic, a 1.5-hr psychiatric assessment interview was conducted by an experienced psychiatrist or psychologist. Information collected in the assessment interview was conferred with experienced mental health professionals working in the clinic before diagnosis was settled and the patient could start relevant treatment. In the current study, only patients suffering from depression, social anxiety disorder, panic disorder, or agoraphobia were included in the clinical group. Patients suffering from organic brain disorders, alcohol/substance abuse or dependence, psychosis, schizophrenia, bipolar disorder, or acute suicide risk were not included in the study. Also, patients with comorbid depression, anxiety disorder, or personality disorder were not excluded from the study's clinical group. All participants recruited for the clinical group were enrolled in treatment in the Psychotherapy Clinic when included in the current study. The treatment consisted of 14 weeks of 1.5-hr group-based Cognitive Behavioral Therapy (CBT) for depression or anxiety disorders delivered by experienced and trained CBT therapists. Participants in the clinical group were all given approximately $15 for their participation. All participants had normal or corrected-to-normal vision and were allowed to wear their glasses or contact lenses if required during the attention task.

Measures

The attentional assessment task (Grafton & MacLeod, 2012) measures the engagement and disengagement components of attentional bias. The version of the attentional assessment task used in the present study consisted of 160 trials in total. The task comprised 60 engagement trials, 60 disengagement trials, and 40 no-response trials. The engagement and disengagement conditions had 30 trials with an emotional target and 30 trials with a neutral target. The task also included 20 practice trials with neutral pictures that were not included in the experimental trials. The task was created and presented in Eprime 2.0 on a Lenovo laptop. The display screen was a 17″ monitor with a resolution of 1,280 × 1,024 running at 60 Hz. Responses were obtained using a PST serial response box. Data were analyzed using IBM SPSS Statistics 25.

Stimuli were taken from the International Affective Picture System (IAPS; Lang et al., 1997), which is a set of images with different emotional valence, arousal, and dominance." to "The International Affective Picture System (IAPS; Lang et al., 1997) is a set of images with different emotional valence, arousal, and dominance. The present study used the same stimuli as Ellenbogen and Schwartzman (2009) that comprised 15 threat, 15 dysphoria, and 15 neutral pictures, which were all unique. An IAPS questionnaire, presenting all pictures used in the attentional assessment task, was also included. The pictures were presented in a random order. The participants were asked to rate each picture on a 9-point scale ranging from 0 = *not unpleasant* to 8 = *very unpleasant*. In the present study, internal consistency of the IAPS questionnaire was excellent ($\alpha = .96$).

The Depression Anxiety Stress Scales (DASS; Lovibond & Lovibond, 1995) is a questionnaire that measures anxiety, depression, and stress. The total DASS consists of 42 items and three subscales. All

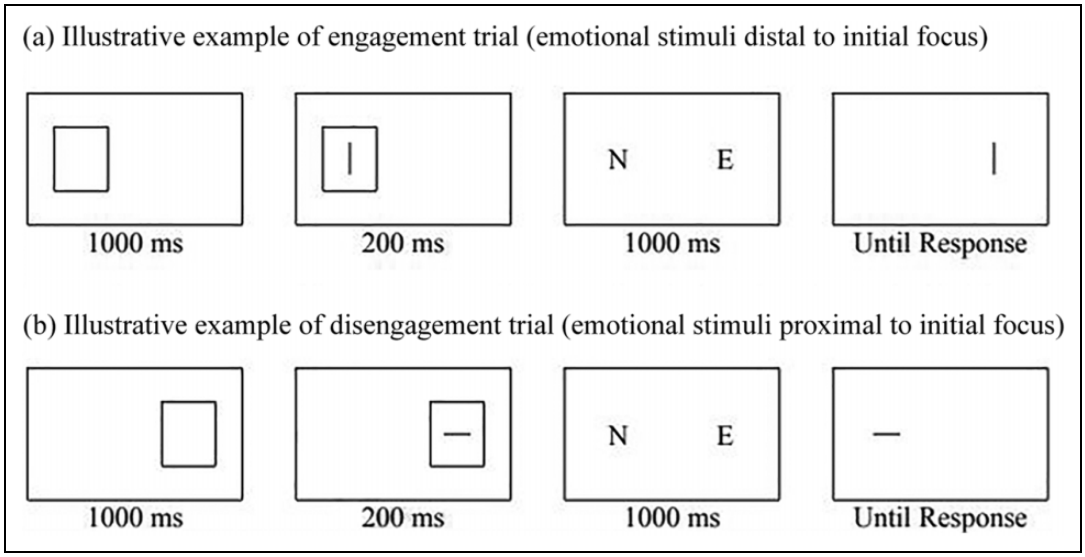

Figure 1. Illustrative trial outlines for engagement trials (a) and disengagement trials (b). Stimuli are either emotional (E) or neutral (N) on opposite sides. The line before the stimuli (anchor probe) must be matched with the line after the stimuli (target probe).

subscales consist of 14 items rated on a 4-point scale containing: 0 = *did not apply to me at all*, 1 = *applied to me to some degree, or some of the time*, 2 = *applied to me to a considerable degree, or a good part of the time*, 3 = *applied to me very much, or most of the time*. The cutoffs for the subscales are *normal* (depression: 0–9, anxiety: 0–7, stress: 0–14), *mild* (depression: 10–13, anxiety: 8–9, stress: 15–18), *moderate* (depression: 14–20, anxiety: 10–14, stress: 19–25), *severe* (depression: 21–27, anxiety: 15–19, stress: 26–33), *extremely severe* (depression: >28, anxiety: >20, stress: >34). In the present study, internal consistency of the DASS questionnaire was excellent ($\alpha = .94$).

Procedure

Firstly, participants were given verbal and written information about the study and a consent form. Then the participants took part in the attentional assessment task. Finally, the participants filled out the IAPS and DASS questionnaires.

In the attentional assessment task, participants are to match two lines presented consecutively on the screen. First, the participant sees a red square on either the left or the right side of the screen (see Figure 1). In the red square, either a horizontal or vertical line is presented (i.e., anchor probe). Then two pictures are presented, one on the left side and one on the right side of the screen, followed by a new horizontal or vertical line presented (i.e., target probe) on either the left or the right side of the screen. The participant is instructed to press the left button if the line following the pictures is on the left side of the screen, and to press the right button if the line following the pictures is on the right side of the screen. Furthermore, the participant is also instructed to only respond if the two lines match in orientation (i.e., vertical/vertical or horizontal/horizontal) but to withhold the response if they do not match (i.e., vertical/horizontal or horizontal/vertical). Finally, the participant is instructed to respond as quickly as possible, but to be careful not to press incorrectly.

Only trials with accurate responses were included in the analysis, and response times (RTs) 1.96 standard deviations from the mean of the participants were considered outliers and removed before further analysis. Engagement bias and disengagement bias were calculated for each participant using the following equations (see Grafton & MacLeod, 2016). *Engagement bias*: (Anchor probe in locus of neutral picture: mean RT for target probe in locus of neutral picture) − (Anchor probe in locus of neutral picture: mean RT for target probe in locus of emotional picture). A positive engagement bias suggests enhanced engagement to emotional pictures. *Disengagement bias*: (Anchor probe in locus of emotional picture: mean RT for target probe in locus of neutral picture) – (Anchor probe in locus of emotional picture: mean RT for target probe in locus of emotional picture). A positive disengagement bias suggests delayed disengagement from

Table 1. Descriptive statistics.

	Clinical ($N = 54$)		Control ($N = 54$)	
	M	(*SD*)	*M*	(*SD*)
Age	33.70	(10.35)	30.22	(7.20)
DASS anxiety	14.48	(9.80)	4.41	(5.94)
DASS depression	14.63	(9.70)	3.41	(6.90)
DASS stress	21.07	(7.94)	8.85	(8.32)
IAPS threat	53.67	(26.48)	50.09	(21.29)
IAPS dysphoria	67.80	(24.46)	65.18	(19.23)
IAPS neutral	6.41	(8.20)	3.58	(5.98)
Error (% trials)	1.47	(1.69)	0.90	(1.07)
Missing (% trials)	5.48	(2.02)	4.78	(1.68)
Engagement threat (ms)	41.36	(49.76)	25.79	(38.28)
Engagement dysphoria (ms)	27.91	(45.97)	19.11	(41.35)
Disengagement threat (ms)	−48.10	(48.08)	−27.00	(40.87)
Disengagement dysphoria (ms)	−39.56	(52.50)	−23.43	(42.01)

Note. DASS = Depression Anxiety Stress Scales; IAPS = International Affective Picture System; *M* = mean; *SD* = standard deviation.

emotional pictures and a negative disengagement bias suggests attentional avoidance of emotional pictures. The split-half reliability of the engagement bias index ($\alpha = .71$) and the disengagement bias index ($\alpha = .70$) was acceptable.

Results

Questionnaires

Independent samples *t*-tests were conducted to investigate between-group differences on the DASS questionnaire and the IAPS questionnaire, respectively. The clinical group scored significantly higher on the DASS anxiety subscale, $t(106) = 6.46$, $p < .001$, $d = 1.24$, on the DASS depression subscale, $t(106) = 6.92$, $p < .001$, $d = 1.33$, and on the DASS stress subscale, $t(106) = 7.81$, $p < .001$, $d = 1.50$, compared with the control group (see Table 1). On average, the clinical group had scores reflecting moderate anxiety and moderate depression while the control group had scores reflecting normal (i.e., insignificant) levels of anxiety and depression. Results from the IAPS questionnaire showed that the clinical group rated the IAPS neutral pictures as significantly more unpleasant than the control group, $t(106) = 2.03$, $p = .045$, $d = 0.39$. No group differences were observed for the threatening pictures or the dysphoric pictures.

Attentional assessment task

A 2 × 2 × 2 mixed-design analysis of variance (ANOVA) with group (clinical vs. control) as between-subject factor and attentional bias type (engagement bias vs. disengagement bias) and emotional stimulus type (threat stimuli vs. dysphoria stimuli) as within-subject factors was conducted. The analysis revealed a significant main effect of bias, $F(1, 106) = 85.36$, $p < .001$, $\eta^2 = .45$, and a significant Bias × Stimulus interaction, $F(1, 106) = 8.16$, $p = .005$, $\eta^2 = .07$. Of more importance, the analysis revealed a significant Group × Bias interaction, $F(1, 106) = 5.09$, $p = .026$, $\eta^2 = .05$. Post hoc Bonferroni-corrected independent samples *t*-tests revealed no significant difference in engagement to emotional stimuli between the clinical group and the control group, $t(106) = 1.64$, $p = .103$, $d = 0.32$, but significantly faster disengagement from emotional stimuli in the clinical group than in the control group, $t(106) = 2.39$, $p = .018$, $d = 0.46$.

Subgroup analysis

In order to investigate differences in engagement and disengagement associated with differences in anxiety and depression, highly symptomatic clinical participants were compared to controls in two separate analyses. First, we compared the group of clinical participants, who scored above moderate anxiety on the DASS anxiety subscale ($n = 34$), to the control group. Second, we compared the group of clinical participants, who scored above moderate depression on the DASS depression subscale ($n = 30$), to the control group.

A 2 × 2 × 2 mixed-design ANOVA with group (anxiety vs. control) as between-subject factor and

attentional bias type (engagement bias vs. disengagement bias) and emotional stimulus type (threat stimuli vs. dysphoria stimuli) as within-subject factors was conducted. The analysis of the anxiety group versus the control group revealed a significant main effect of bias, $F(1, 86) = 86.38$, $p < .001$, $\eta^2 = .50$. More importantly, the analysis revealed a significant Group $\times$ Bias interaction, $F(1, 86) = 7.57$, $p = .007$, $\eta^2 = .14$. Post hoc Bonferroni-corrected independent samples t-tests revealed no significant difference in engagement to emotional stimuli between the anxiety group and the control group, $t(86) = 1.69$, $p = .094$, $d = 0.36$, but significantly faster disengagement from emotional stimuli in the anxiety group than in the control group, $t(86) = 3.28$, $p = .001$, $d = 0.72$.

A 2 $\times$ 2 $\times$ 2 mixed-design ANOVA with group (depression vs. control) as between-subject factor and attentional bias type (engagement bias vs. disengagement bias) and emotional stimulus type (threat stimuli vs. dysphoria stimuli) as within-subject factors was conducted. The analysis of the depression group versus the control group revealed a significant main effect of bias, $F(1, 82) = 51.64$, $p < .001$, $\eta^2 = .39$, and a significant Bias $\times$ Stimulus interaction, $F(1, 82) = 1.25$, $p = .01$, $\eta^2 = .08$. No interactions involving group reached significance in the depression group versus the control group analysis, and thus no further subanalyses were conducted.

Discussion

The main result of the present study was the significant interaction between bias and group, which suggested that the clinical group and the control group showed differences in disengagement from emotional stimuli, but no differences in engagement to emotional stimuli. Overall, the results of the present study suggested that all participants showed enhanced engagement to emotional stimuli and attentional avoidance of emotional stimuli, but that the clinical group showed more attentional avoidance of emotional stimuli than the control group. The main result of the subgroup analysis was the interaction between bias and group found between the anxiety group and the control group, which suggested that the anxiety group showed more attentional avoidance of emotional stimuli than the control group. Interestingly, no significant interactions involving group were found between the depression group and the control group. This suggests that the effect of more attentional avoidance of emotional stimuli may be limited to symptoms of anxiety and not symptoms of depression.

Overall, the result of the present study is similar to the result of the comparison between anxious and control participants from the study by Ellenbogen and Schwartzman (2009), but different from the comparison between depressed and control participants from the same study. In contrast to the prediction based on the results from the study by Ellenbogen and Schwartzman (2009), the present study did not find any group differences with regard to stimuli. Similarly, eye-tracking studies investigating engagement and disengagement in anxious participants have found evidence of attentional avoidance of emotional stimuli (Armstrong et al., 2013; Chen et al., 2012), whereas eye-tracking studies investigating engagement and disengagement in depressed participants have found evidence of delayed disengagement from depression-related stimuli (Sanchez et al., 2013; Sears et al., 2010).

The result of the present study supported the association between attentional avoidance and anxiety proposed by the model of Cisler and Koster (2010), but it did not support the association between delayed disengagement and depression proposed by the model of Koster et al. (2011). To further test the model of attentional bias in anxiety, future studies should investigate whether the association between attentional avoidance and anxiety is mediated by emotion regulation as proposed by the model of Cisler and Koster (2010). Future studies should also further investigate the association between attentional avoidance and other cognitive biases (i.e., interpretation, memory, cognitive control) as suggested by the combined cognitive biases hypothesis (Everaert et al., 2012; Hirsch et al., 2006).

Previous studies using the attentional assessment task suggest that anxiety is associated with enhanced engagement to negative stimuli (Grafton & Macleod, 2016) and delayed disengagement from negative stimuli (Grafton & MacLeod, 2014; Rudaizky et al., 2014). High ruminative disposition and low positive affectivity have both been linked to depression. Studies using the attentional assessment task suggest that high ruminative disposition is associated with delayed disengagement from negative stimuli (Grafton et al., 2016; Southworth et al., 2017) and that low positive affectivity is associated with attentional avoidance of negative stimuli (Grafton et al., 2012). The present study found that the clinical group showed more attentional avoidance of emotional stimuli than the

control group. However, this effect may be limited to symptoms of anxiety and not symptoms of depression. Similarly, recent studies with clinically anxious participants have found attentional avoidance of threat (Blicher & Reinholdt-Dunne, 2019; Yiend et al., 2015), whereas most previous studies with subclinical participants have found delayed disengagement from threat (e.g., Fox et al., 2001; Yiend & Mathews, 2001).

The present study also found that the clinical group evaluated the neutral pictures as more unpleasant than the control group. This suggests that the threshold for appraising emotional stimuli for clinical participants was lower than the threshold for control participants. This finding matches the cognitive-motivational perspective proposed by Mogg and Bradley (1998). According to their findings, vulnerability to anxiety stems mainly from a lower threshold for appraising threat, rather than a bias in the direction of attention deployment. Thus, Mogg and Bradley (1998) posit that, while everyone orients to stimuli which are judged to be significantly threatening, high trait anxious individuals evaluate even innocuous stimuli as highly threatening.

Basic research in experimental psychopathology has highlighted how targeting attentional bias to emotional stimuli is a fundamental approach in the treatment of emotional disorders. In particular, attentional bias modification (ABM) is training faster disengagement from emotional stimuli. For instance, Amir et al. (2009) conducted a randomized controlled trial of attention training in individuals with social anxiety disorder. In their study, participants in the treatment condition had to react to a probe that was consistently presented in the location of neutral stimuli when combined with threatening stimuli, thus guiding their attention away from the threat. Results suggested that the treatment condition enabled attentional disengagement from threat and decreased symptoms of social anxiety (Amir et al., 2009).

Training faster disengagement from emotional stimuli is motivated by previous studies which have found delayed disengagement from threat (e.g., Fox et al., 2001; Yiend & Mathews, 2001). However, these studies were conducted using subclinical and not clinical samples. The main result of the present study suggests that clinical participants show more attentional avoidance of emotional stimuli than control participants. Thus, effectively training faster disengagement from emotional stimuli, as suggested by ABM based on results from subclinical samples, would increase attentional bias and not decrease it. In effect, training attention away from emotional stimuli may potentially alleviate emotional disorders momentarily, but may also prevent overall treatment success. Indeed, cognitive therapy of emotional disorders identifies avoidance as a maladaptive coping strategy which maintains heightened levels of emotional difficulties over time, whereas prolonged exposure reduces dysfunction (e.g., Beck & Clark, 1997).

The present study is not without limitations. A general limitation of reaction-time paradigms is that they cannot be used to distinguish between covert attention (i.e., focusing of attention without shifting gaze) and overt attention (i.e., focusing of attention by shifting gaze). Eye-tracking technology offers a more direct measure of overt attention and may therefore provide important additional knowledge about the engagement and disengagement components of attentional bias. Also, the present study only used an exposure duration of 1,000 ms. Future studies may use different exposure durations to investigate the temporal dynamics of attentional biases, because previous studies have revealed differences in engagement and disengagement depending on the exposure duration (e.g., Ellenbogen & Schwartzman, 2009; Koster et al., 2006).

Another limitation of the present study was the composition of the experimental groups. Due to the large comorbidity between anxiety and depression, the clinical group was compared to the control group based on elevated anxiety/depression symptoms. In addition, the clinical group was enrolled in treatment with cognitive therapy, which has been suggested to reduce attentional avoidance of threat (Blicher & Reinholdt-Dunne, 2019). Also, the present study used threat, dysphoria, and neutral pictures from the IAPS as stimuli. Future studies may use different stimuli (e.g., words) or different valence categories (e.g., positive pictures) to further elucidate the underlying mechanisms of selective attention in anxiety and depression.

The main limitation of the attentional assessment task is that participants need to remember the anchor probe in order to respond to the target probe. Thus, the task does not only measure attention, but it also relies on short-term memory. The reason for matching the anchor probe and the target probe is to secure attention on a predetermined initial focus. Accordingly, eye-tracking technology would be able to eliminate the issue of short-term memory by using a task that requires the participant to fixate on a particular

location on the screen before the start of each trial and only to proceed with the task after fixation on the particular location. Future studies may therefore wish to replicate and expand on the present findings using eye-tracking methodology. Another limitation of the attentional assessment task is that the stimuli and the probe are presented with different temporal onsets. Consequently, the task may measure not only engagement to the stimuli but also disengagement from the stimuli and engagement to the probe. Future studies may circumvent this problem by performing a detection task in which the stimuli and the probe are presented simultaneously (e.g., visual search tasks).

In conclusion, the present study suggests that clinical participants show more attentional avoidance of emotional stimuli than control participants. However, this effect may be limited to symptoms of anxiety and not symptoms of depression. The present study highlights that further research into the mechanisms of selective attention in clinical samples is warranted before the results can be generalized and used in treatment.

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Authors' note

Anders Petersen and Signe Vangkilde shared last authorship.

Declaration of conflicting interests

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Ethical approval

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