

**Manipulating avoidance motivation to modulate attention bias for negative information in  
dysphoria: An eye-tracking study**

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### **Highlights**

- Generally, instrumentality of achieving goals guides attention to relevant stimuli
- Attentional bias for negative stimuli in depression, regardless of goal relevancy
- Punishment avoidance-related stimuli received priority over simple negative stimuli
- Manipulating underlying avoidance motivation can modulate the attentional bias
- Punishment related goals can be applied to improve attention training outcomes

## Abstract

**Background and Objectives:** Instrumentality plays a key role in guiding attention, such that stimuli associated with achieving current goals of an individual prioritize attention. However, in depression, attention is prioritized to negative stimuli even when they are not relevant to current goals. In the current study, we tested whether attention is prioritized to stimuli that are associated with avoidance of imminent negative consequences over negative affective stimuli.

**Methods:** Using an eye-tracking based attention engagement-disengagement task, we presented pairs of negative faces, and neutral faces associated with avoidance of punishment (white noise and lost money) to a group of dysphoric and non-dysphoric individuals.

**Results:** First, we replicated previous evidence on difficulties to disengage attention from negative stimuli, when prompted to direct eye-gaze towards simple neutral stimuli, in dysphoric compared to non-dysphoric individuals. Further, we found that both dysphoric and non-dysphoric individuals were faster to disengage their attention from negative pictures when prompted to direct eye-gaze towards punishment avoidance-related neutral stimuli, versus towards simple neutral stimuli.

**Limitations:** Although we seek to clarify the attention processes underlying depression, the current study employed a sub-clinical sample in order to serve as proof-of-concept study.

**Conclusions:** Our results indicate that stimuli instrumental to the goal of avoiding negative consequences receive preference in the attention system over simple negative affective stimuli. Our findings suggest that manipulating the instrumentality of avoidance motivation can effectively modulate the attention bias for negative information in dysphoria, and also possibly in depression, akin to the modulation patterns in non-dysphoric individuals.

*Keywords:* attention, negative, avoidance, goals, eye-tracking

## **1. Introduction**

Selective attention towards stimuli in the environment is guided by the goals of an individual within that situation (Allport, 1989; Corbetta & Shulman, 2002; Vogt, De Houwer, & Crombez, 2011). The goals of an individual within any given context can be said to be guided by the motivation to approach positive consequences or avoid negative consequences (Carver & Scheier, 1990; Trew, 2011). As such, attention is assumed to be prioritized towards stimuli that are associated with specific goals of the individual. Recently, research has started to show that instrumental stimuli, which are relevant to current goals, receive more attentional priority than non-instrumental stimuli which are at odds with current goals (Vogt, De Houwer, & Crombez, 2011; Vogt, De Houwer, & Moors, 2011). In a recent study, Vogt, Koster & De Houwer (2016), tested how attention is prioritized when simple negative stimuli are presented in competition with other negative or neutral stimuli associated with instrumentality to avoid negative outcomes. Instrumentality associations were first done through a secondary task. In a first experiment, this secondary task was used to induce the goal of avoiding the administration of a harsh sound by pressing a button when viewing a neutral picture. In a further experiment, this instrumental association (i.e., avoidance of a harsh sound) was done for a negative picture. They then used a dot-probe attention task in the main task to test attention to these new instrumental neutral or negative pictures in comparison with other threatening pictures which were not associated with instrumental avoidance of negative consequences (i.e., avoid the harsh sound) in real-time. They found that the instrumental “safety” cue, i.e. the avoidance goal-related neutral or negative picture, received preferential attention over other non-instrumental threatening cues (i.e., no instrumental negative pictures). These results suggest that, in healthy individuals, attention to both non-emotional (neutral) and negative (threatening) information can operate as a function of instrumentality (Vogt, Koster & De Houwer, 2016), i.e. the ability to achieve the goal

of avoiding associated negative consequences (Notebaert, Crombez, Van Damme, De Houwer, Theeuwes, 2011; Cesario, Plaks, Hagiwara, Navarrete, & Higgins, 2010).

In contrast to such flexible motivation-guided attention selectivity, rigid attention prioritization towards negative information is a well-studied phenomenon in the context of depression. An excessive attention bias for negative information is a hallmark for both depression and dysphoria, and it is marked by difficulties in disengagement of attention from negative stimuli (De Raedt & Koster, 2010; Koster, De Raedt, Leyman, & De Lissnyder 2010; Sears, Thomas, LeHuquet, & Johnson, 2010). Both clinically and subclinically depressed individuals show sustained attention to negative information when prompted to disengage attention from it, which predicts dysfunctional stress coping and regulation responses (Sanchez, Romero & De Raedt, 2017; Sanchez, Vazquez, Marker, LeMoult, & Joormann, 2013). Depressed and dysphoric individuals might therefore display reduced responsiveness to instrumentality as their attention becomes oriented to negative emotional information in a chronic manner. Nonetheless, no study so far has directly examined, in the context of depression and dysphoria, how attention operates when non-instrumental negative emotional stimuli are presented with further alternative stimuli which can be instrumental in avoiding negative consequences. In the current study we examined whether instrumental neutral stimuli can override existing attention biases for non-instrumental negative emotional stimuli in both healthy and subclinically depressed (dysphoric) individuals, as this may have important implications for future interventions aimed to modify distorted attentional processes involved in dysfunctional emotional functioning.

For the purpose of this study, we employed the attention engagement-disengagement task (Sanchez et al., 2013, 2017), to test attentional disengagement from negative emotional faces. In

the attention engagement-disengagement task, participants are presented pairs of neutral and negative face expressions. After participants naturally fixate on one of the faces, a probing frame appears around the opposing face. This requires participants to shift their eye-gaze to attend to the framed image and respond to the shape of the frame by pressing one of two buttons. Depressed individuals, compared to healthy controls, tend to have greater difficulties to disengage from the negative face to direct attention towards framed neutral image, indicating an attention bias for negative stimuli in depression (Sanchez et al., 2013). Using the disengagement condition of this eye-tracking task, we presented pairs of negative and neutral faces, with the neutral faces being simple non-reinforced or reinforced goal stimuli associated with instrumentality to avoid negative consequences. We measured how quickly participants were able to disengage their attention from the negative emotional face, and direct it towards either a standard neutral face or an instrumental goal neutral face that had been reinforced with the avoidance of punishment. To induce the instrumental goal, we alternated the trials of the attention task with the trials of a goal-inducer task. Similar to the procedure of Vogt et al. (2016), participants learned to associate that pressing a button for a certain neutral face would allow them to avoid negative consequences, namely the application of a harsh sound (white noise) and loss of money. Because in our study we included both dysphoric and non-dysphoric individuals, we applied both primary and secondary reinforcement (white noise and money loss, respectively) to induce avoidance motivation. Due to reduced sensitivity to monetary rewards in depressive states (Barch, Pagliaccio & Luking, 2015; Hervas & Vazquez, 2013; Pizzagalli, Iosifescu, Hallett, Ratner, & Fava, 2008), inducing avoidance motivation for loss of money in dysphoric participants would be less effective. However, since healthy individuals do not have an impaired sensitivity to monetary rewards, loss of money could be more motivating to non-dysphoric

individuals (Henriques & Davidson, 2000; Pizzagalli et al., 2008; Pizzagalli, Jahn, & O'Shea, 2005). Therefore, to induce balanced incentive motivation in the two groups, we employed both harsh sound (white noise) and money loss to motivate avoidance goals. We then presented the reinforced goal stimulus in combination with negative faces in the main disengagement task, and examined how quickly participants were able to disengage their eye-gaze from the negative face and direct it towards the instrumental goal face (i.e., associated with avoidance of negative consequences in the goal-inducer task), in comparison to standard non-instrumental neutral faces.

In addition to testing attentional disengagement from negative faces in 'standard neutral' and 'goal neutral' conditions, we also introduced a third, 'action neutral' condition. In the goal-inducer task, participants had to press a button for a particular goal picture in order to avoid negative consequences (i.e., listening to the white noise and money loss). However, action-relevant stimuli, which are not reinforced with any reward or punishment, also guide and prioritize attention (Bekkering & Nèggers, 2002). This implies that in the goal-inducer task, the action of simply pressing the button could create a stimulus-response contingency, which might lead to biasing of attention towards the particular goal stimulus. In order to isolate the impact of avoidance goals in motivating attention towards goal stimulus, a third "action neutral" condition was included, requiring participants to press the button for another, unique neutral face in the goal-inducer task. However, the button-press in this 'action neutral' condition was not reinforced with avoidance of punishment. This allowed us to compare whether attentional effects created by the actual 'goal neutral' stimulus were, in fact, not an artifact of the action contingency but due to an impact of avoidance motivation.

In line with previous literature on attention biases for negative information (Albert et al., 2017; De Raedt & Koster, 2010; Duque, Sanchez, & Vazquez, 2014; Koster, De Raedt, Goeleven, Franck, & Crombez, 2005; Sanchez et al., 2013, 2017; Sears et al., 2010), we expected that dysphoric compared to non-dysphoric individuals would have more difficulties (i.e., longer times) to disengage attention from the negative faces to direct their eye-gaze towards standard neutral faces. Further, we examined whether it is possible for punishment avoidance-reinforced goal stimuli to override this attention bias in dysphoric individuals. If goal stimuli do create a strong prioritization of attention resources for instrumental over non-instrumental negative signals, then dysphorics, just like non-dysphorics, would find it easier to disengage attention from negative stimuli when it is presented in combination with a goal stimulus. Therefore, we tested whether healthy and subclinically depressed (dysphoric) individuals would show faster attention disengagement from negative stimuli patterns in the goal condition compared to the standard and action neutral conditions.

## **2. Method**

### **2.1 Participants**

Fifty-five individuals took part in the study (41 females, *Sample M<sub>age</sub> = 22.58*, *Sample SD<sub>age</sub> = 5.07*, 18 – 32 years). The participants were pre-selected from the Ghent University participant pool ( $N = 137$ ; 95 females, 42 males; 83 individuals 18-20 years old, 54 individuals 21 years or older) based on their scores on the Anhedonic Depression (AD) scale of the Mood & Anxiety Symptoms Questionnaire – Dutch (MASQ-D; Wardenaar et al., 2010). Participants were included in the dysphoric group if they scored in the top 25% of AD scores, and in the non-dysphoric group when they scored in the bottom 25% scores of the participant pool. All the



participants had normal or corrected-to-normal (using glasses or contact lenses) vision. Participants were excluded from the study if they reported current or history of psychiatric problems. Even though 55 individuals took part in the study, the data of two participants were excluded from analysis due to low quality of eye-gaze data (<75% eye-gaze samples obtained) and/or the presence of clinical conditions of psychopathology<sup>1</sup>. Finally, 29 individuals formed the dysphoric group ( $M_{MASQ} = 31.97$ ,  $SD_{MASQ} = 6.84$ ) and 24 formed the non-dysphoric group ( $M_{MASQ} = 19.05$ ,  $SD_{MASQ} = 1.91$ ), as measured at the time of lab testing (participants in our sample scored in the range 15-45 on the AD subscale). The sample size for the study was estimated using G-Power (Faul, Erdfelder, Lang, & Buchner, 2007), prior to data collection, based on a power of .80, an alpha of .05, an expected medium sized ( $f = 0.25$ ) within-between interaction, and the unknown correlation among repeated measures set at 0. The study was approved by the Ethical Committee of the Faculty of Psychology & Education Sciences at Ghent University. All participants provided informed consent and received compensation for their participation (€12). We analyzed sample characteristics for group differences. We conducted a chi-square test to examine between-group differences amongst dysphoric ( $n = 29$ ; 17 females) and non-dysphoric ( $n = 24$ ; 22 females) groups based upon the gender of the participants. Although we found an overall significant chi-square test,  $\chi^2(1, N = 53) = 7.38$ ,  $p = .007$ , there was no significant interaction detected between gender and the independent variables ‘Group’ and ‘Condition’. Further, we did not find any between-group differences amongst dysphoric ( $M_{age} = 22.31$  years,  $SD = 3.51$ ) and non-dysphoric ( $M_{age} = 23.04$  years,  $SD = 6.66$ ) groups based on the age of the participants,  $t(51) = -.513$ ,  $p > .10$ . Lastly, in line with our sample selection,

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<sup>1</sup> Participants reporting current psychiatric disorders were excluded on the advice of the Ethical Committee of the Faculty of Psychology and Education Sciences at Ghent University. This was done in order to prevent any adverse impact that the punishing reinforcers might have on the individuals, which could potentially aggravate the clinical condition.

there were significant between-group differences based upon the scores on the Anhedonic Depression subscale of the Mood and Anxiety Symptoms Questionnaire – D30,  $t(25) = 11.14$ ,  $p < .001$ .

## **2.2 Materials**

*2.2.1. Questionnaires.* All participants completed MASQ – D30 (Wardenaar et al., 2010), which is the Dutch version of the 30-item short adaptation of the Mood & Anxiety Symptoms Questionnaire (Watson & Clark, 1991). MASQ – D30 is a self-report measure which is used to assess anxiety and depressive symptoms using a 5-point Likert scale (1= not at all, 5= extremely). Out of the 30 items, 10 items are reverse-scored and constitute the depression-specific anhedonic depression (AD) subscale. MASQ – D30 has an internal consistency of .92 in young adults and in adults, and in our sample the Cronbach's alpha was .93.

Further, participants were also administered the MINI-International Neuropsychiatric interview (Sheehan et al., 1998) to detect the presence of current or previous clinical diagnoses of psychopathology. The MINI is a short, structured diagnostic interview to assess DSM-IV and ICD-10 diagnoses, and is divided into different modules, each corresponding to a diagnostic category. No participants were excluded from data analysis based upon their responses on the MINI interview.

*2.2.2. Apparatus.* The stimuli presentation was programmed using E-prime Professional 2.0 (2008). The stimuli were presented on a screen which had a resolution of 1920 x 1080 pixels, a luminance of 300 cd/ m<sup>2</sup>, with a height of 23 inches. Participants were seated 59 – 65 cm from the screen in order to obtain optimum eye-gaze patterns. We used the Tobii TX 300 eye tracker, with a sampling rate of 300 Hz (binocular) (please refer to Bohme et al., 2006 for an overview of the systems underlying eye-tracking technology). Tobii studio was used to convert eye

movement data into reaction times attention disengagement indices by extracting and averaging First Fixation Times to the corresponding AOIs (Area of Interest) in each disengagement condition (see below). The aversive noise used in the experiment was an unpleasant white noise soundwave of 50 dB(A) intensity. (Raes & De Raedt, 2012; Vogt, Koster, & De Houwer, 2016).

*2.2.3. Pictures.* Stimuli used in the current experiment, the negative and neutral facial expressions, were obtained from the Radboud Faces Database (RaFD; Langner et al., 2010). Each picture contained a single individual, male or female, facing towards the front, such that the emotional expression on the face was clearly visible. A total of 61 neutral pictures were taken from RaFD based on median scores of intensity ( $M = 3.4$ ,  $SD = 0.3$ ) and valence ( $M = 3.0$ ,  $SD = 0.3$ ). Two out of the 61 neutral pictures served as the ‘goal neutral’ and the ‘action neutral’ images, while the remaining 59 neutral pictures constituted the ‘standard neutral’ category. From the 2 unique neutral images, we counterbalanced which picture served as the ‘goal neutral’ and ‘action neutral’ images across participants. The ‘negative’ category was composed of 61 negative emotional face expressions (disgust and sad) selected based on high scores for intensity ( $M = 3.7$   $SD = 0.3$ ), and valence ( $M = 2.0$ ,  $SD = 0.2$ ). All the four picture categories, ‘negative’, ‘standard neutral’, ‘goal neutral’ and ‘action neutral’, were shown equally often throughout the entire experiment.

*2.2.4. Attention Engagement-Disengagement Task.* Trials in the attention engagement-disengagement task began with a black fixation cross (5mm high) in the center of a white screen (see Figure 1). Upon eye-gaze fixation on the cross for 100ms, 2 pictures (157 x 237) appeared on the screen adjacent to each other, each 5cm apart from the center of the screen. The pictures could be either one of the following combinations: ‘negative-standard neutral’, ‘negative-goal neutral’ or ‘negative-action neutral’. The four categories (negative, standard neutral, goal neutral,

and action neutral) of faces, and the male and female face expressions were presented equally often on the right and the left side of the screen. For the disengagement trials, participants were instructed to attend to both the faces presented on the screen. After free-viewing for 3000ms, upon spontaneous fixation on the negative picture for 100ms, a green square or circle frame appeared around the adjacent (goal, action or standard neutral) picture. Participants were then instructed to direct their eye-gaze, as quickly as possible, to the framed image and respond to the frame surrounding the face expression of that image, by pressing '1' if they detected a square frame and '2' if they saw a circle, which then terminated the trial. The disengagement from negative trials comprised of three conditions: (1) 'Disengage to standard neutral': participants had to direct their eye-gaze towards the framed 'standard neutral' picture (32 trials), (2) 'Disengage to action neutral': participants had to direct their eye-gaze towards the framed 'action neutral' picture (16 trials), and (3) 'Disengage to goal neutral': participants had to direct their eye-gaze towards the framed 'goal neutral' picture (16 trials). We presented unequal number of trials in the three conditions in order to ensure that each of the four picture categories were presented equally often throughout the entirety of the experiment. In the goal-inducer task, the 'goal neutral' and 'action neutral' images were presented twice as often as the 'negative' and 'standard neutral' images. Therefore, in order to balance the presentation of the pictures through the duration of the experiment, we presented 16 additional trials of the 'Disengage to standard neutral' condition during the engagement-disengagement task.

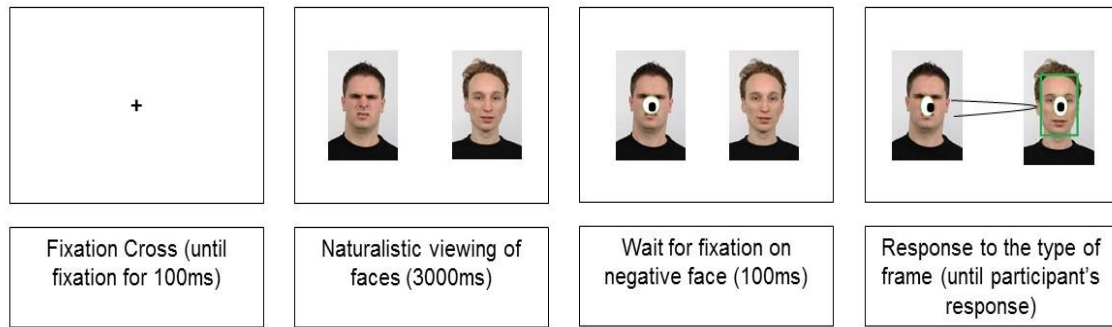


Figure 1. An example of a disengagement trial in the attention engagement-disengagement task.

Since in the disengagement trials the frame always appeared on the picture opposing the negative image, it was possible that participants could learn to detect the location of the frame which would confound their reaction times. To ensure that participants remained naïve to the location of the frame, participants also performed trials which measured attention engagement with negative faces. These trials were similar to the disengagement trials, except that the participants had to direct their attention towards the framed ‘negative’ image after fixating on the ‘goal neutral’, ‘action neutral’ or ‘standard neutral’ image. Participants performed a total of 96 trials of the attention task, with 64 disengagement and 32 engagement trials that were presented

in a pseudo-randomized manner (see below). Each trial of the attention task was followed by a trial of the goal-inducer task.

*2.2.5. Goal-inducer Task.* Trials in the goal-inducer task began with a black fixation cross (5mm high), on a white background (see Figure 2). After 500ms, a single image (157 x 237), from the ‘negative’, ‘standard neutral’, ‘goal neutral’ or ‘action neutral’ categories, appeared in the center of the screen. Participants were instructed to do nothing if the image was from the ‘negative’ or ‘standard neutral’ categories, and the image would automatically disappear after 1000ms. Participants were instructed to press the spacebar as swiftly as possible if the image on the screen belonged to the ‘goal neutral’ or ‘action neutral’ categories. Upon button-press for the ‘goal neutral’ image, participants avoided the loss of .062euro and listening to the white noise. In the event that participants did not press the spacebar for the ‘goal neutral’ image within 1000ms of the onset of the image or pressed the wrong button, they lost .062euro and listened to white noise for 3000ms through a set of headphones (immediate onset with intensity 50 dB(A)). Participants were also instructed to press the spacebar for the ‘action neutral’ image. However, the button-press was not related to the ability to avoid money loss and the white noise application. In case the participants forgot to press the spacebar or pressed the wrong button, the ‘action neutral’ image stayed on the screen until the participants pressed the spacebar. Each trial elapsed with a button-press (for the ‘goal neutral’ or ‘action neutral’ image) or after 1000ms since the presentation of the picture on the screen. Participants performed 24 trials for each category of image, making a total of 96 trials of the goal-inducer task. The goal-inducer task was used to induce instrumentality associations, and no dependent variables were obtained for analysis from this task.



Figure 2. An example of a trial in the goal-inducer task. During the trial when participants did not correctly identify the goal stimulus, they heard the aversive sound through headphones along with indication of money loss on the screen.

### 2.3 Procedure

The experiment began with participants completing the informed consent and the questionnaires. Prior to the experimental tasks, participants underwent an eye-gaze calibration procedure. Next, participants were introduced to the attention task, and they performed 32 practice trials of the engagement condition to familiarize them with the task, yet keep them naïve of the procedure in the main experimental trials. After this, the participants were introduced to the goal-inducer task, listened to a sample of the harsh sound they could hear and were informed about the amount of money they could lose if they failed to correctly identify the ‘goal’ image. Participants then performed 10 practice trials of the goal-inducer task, and 20 practice trials of

the combined attention engagement-disengagement and goal-inducer tasks, before starting to perform the actual combined task (see Figure 3 for trial procedure of the combined task). We hypothesized that dysphoric individuals will show greater difficulties in disengaging, i.e. longer first fixation times, from negative to standard neutral stimuli. Further, we explored whether both dysphoric and non-dysphoric participants would show longer or shorter first fixation times when disengaging from negative stimuli to direct eye gaze towards goal stimulus, compared to standard neutral pictures. Upon completion of the main combined task, participants were asked to respond to a single self-report question, “Which of the two punishment reinforcers, white noise or money loss, did you find to be more motivating?”, and participants had to respond with the response “white noise”, “loss of money”, or “both”. Finally, the participants were debriefed about the purpose of the study and compensated for their time.

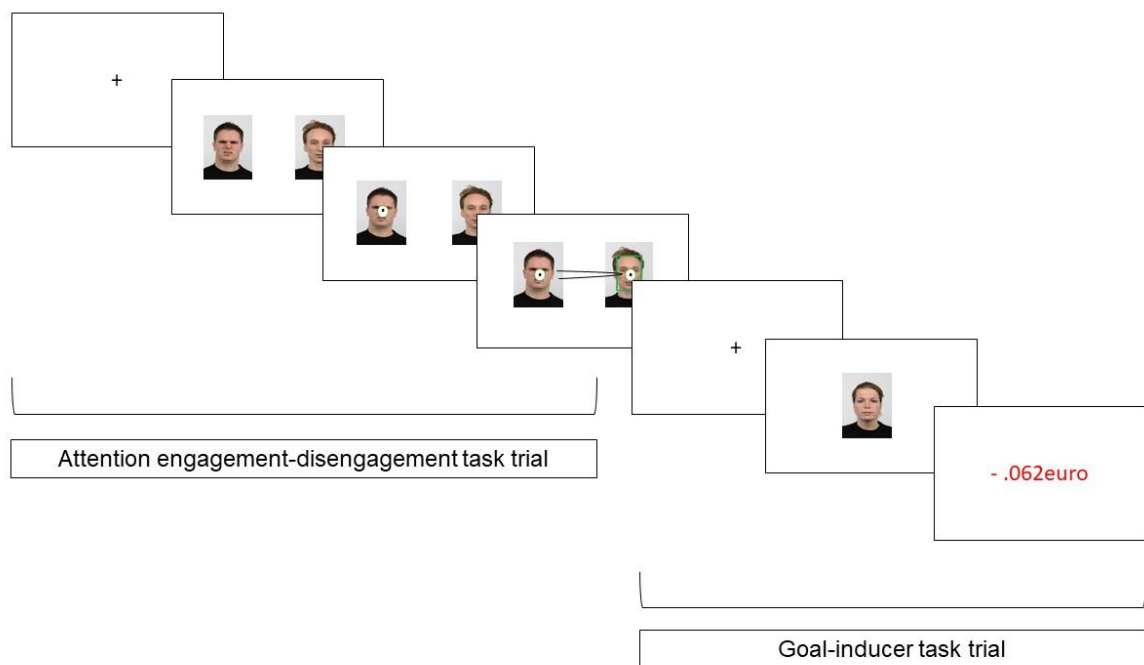


Figure 3. The combined trial procedure for the attention engagement-disengagement and goal-inducer tasks.



## 2.4 Data Preparation

Times to first fixate the framed image in the disengagement task (i.e. how swiftly participants disengaged their attention from the negative image to engage with the opposite framed image since the moment the frame appearance), were obtained from the eye-gaze recordings for each disengagement trial in the attention task. For each participant, we computed average first fixation time indices corresponding to the three disengagement conditions: ‘Disengage to standard neutral’, ‘Disengage to action neutral’, and ‘Disengage to goal neutral’. Prior to calculating the first fixation time indices for the three conditions, we removed outlier data. All first fixation times to the framed face greater than 1000ms or less than 100ms were set to missing, including missing scores (4% data set to missing). The three attention disengagement indices were then obtained by calculating the mean of all the first fixation time scores in that condition<sup>2</sup>.

## 3. Results

Using the disengagement indices as the dependent variable, we conducted a 2 (Group) x 3 (Condition) mixed analysis of variance. In the analysis, Group (Dysphoric vs. Non-Dysphoric) was a between-subjects factor, and Condition (‘Disengage to standard neutral’, ‘Disengage to action neutral’, and ‘Disengage to goal neutral’) was a within-subjects factor.

First, we found a main effect of Group,  $F(1, 51) = 21.36, p < .001, \eta_p^2 = .30$ , showing that the dysphoric group, across the three levels of Condition, were slower in disengaging attention

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<sup>2</sup> We calculated the internal consistency for each of the three conditions, with all attention indices demonstrating excellent psychometric properties: ‘Disengage to standard neutral’ ( $\alpha = .97$ ), ‘Disengage to action neutral’ ( $\alpha = .95$ ), and ‘Disengage to goal neutral’ ( $\alpha = .95$ ).

from negative and directing eye-gaze to framed neutral images as compared to the non-dysphoric group. This is in line with our first hypothesis wherein we expected dysphoric, compared to non-dysphoric, participants to be slower in disengaging their eye-gaze from standard neutral material. Importantly, the analysis also revealed a significant main effect of Condition,  $F(2, 102) = 29.79$ ,  $p < .001$ ,  $\eta_p^2 = .37$ . Individuals in both groups were faster in disengaging eye-gaze from negative images and directing gaze to framed ‘goal neutral’ images, as compared to both ‘standard neutral’,  $t(52) = 6.10$ ,  $p < .001$ ,  $d_{av} = .61$ , and ‘action neutral’,  $t(52) = 7.33$ ,  $p < .001$ ,  $d_{av} = .59$  (see Figure 4). This finding corresponds to our research question examining the ability of goal stimuli to override attention for negative stimuli, as evidenced by faster disengagement from negative stimuli. Moreover, disengagement times from negative to ‘standard neutral’ images did not differ from disengagement times from negative to ‘action neutral’ images,  $t(52) = -.09$ ,  $p = .925$ ,  $d_{av} = -.01$ . Lastly, we did not find a significant interaction between Condition and Group,  $F(2, 102) = 1.56$ ,  $p > .21$ ,  $\eta_p^2 = .03$ <sup>3</sup>. These results suggest that both groups followed a similar pattern of faster disengagement from negative to goal neutral framed images compared to standard neutral and action neutral stimuli.

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<sup>3</sup> We also analyzed the self-report data pertaining to the question “Which reinforcer, white noise or money loss, did you find more motivating?”. Analysis revealed that 83% (rounded to nearest digit) of the individuals in the dysphoric group (N = 24) found white noise to be a more motivating reinforcer during the goal-inducer task, and 17% (rounded to the nearest digit) in the dysphoric group (N = 5) found both money loss and white noise to be equally motivating. Similarly, 75% of the individuals in the non-dysphoric group (N = 18) found white noise to be more motivating than the money loss, while 2 individuals found money loss to be more motivating, and 4 individuals reported they found both to be equally motivating

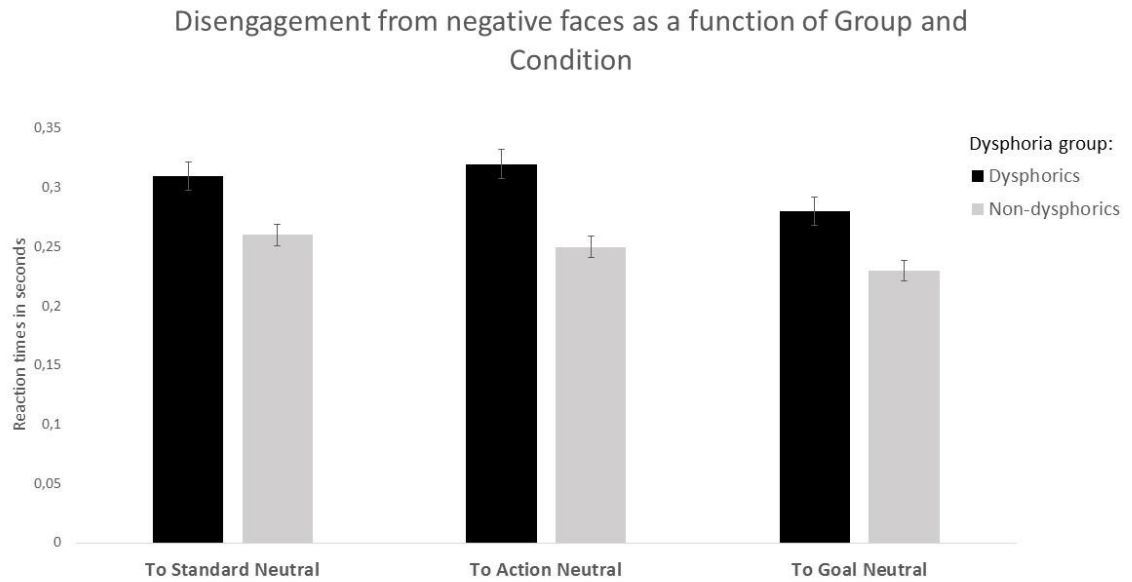


Figure 4. First fixation to the framed picture scores for both dysphoric and non-dysphoric individuals for the three disengagement conditions. Error bars represent standard error.

#### 4. Discussion

The results from the current study show that goal-relevant stimuli, which are instrumental in avoiding negative consequences, can modulate attention for negative emotional information in dysphoric and non-dysphoric individuals. We found that punishment avoidance-reinforced goal stimuli modulated a pre-existing dysphoria-related attention bias (i.e., longer times to disengage attention from negative faces in dysphoric compared to non-dysphoric individuals in standard conditions), such that dysphoric individuals were faster to disengage eye-gaze from the negative stimuli when it was presented in combination with goal rather than the standard and action neutral faces. Similarly, non-dysphoric individuals also displayed a pattern of faster

disengagement from negative stimuli to direct eye-gaze towards goal, compared to standard neutral, stimuli.

In line with previous literature (Albert et al., 2017; Koster et al., 2005; Leyman et al., 2011; Sanchez et al., 2013, 2017; Sears et al., 2010), we found that dysphoric, compared to non-dysphoric, individuals faced greater difficulties to disengage their attention from negative faces when they were presented in combination with neutral faces. This latter finding further confirms the existence of an attention bias towards negative emotional information in individuals with dysphoria. However, when negative emotional stimuli were presented in combination with punishment avoidance-reinforced goal stimuli, the attentional priority for goal stimuli modulated this attention bias for negative stimuli in dysphoric individuals. A similar pattern of results was obtained for non-dysphoric individuals as well, who also displayed faster disengagement of attention from negative stimuli towards avoidance-related goal stimuli compared to simple neutral faces. These findings provide support for the concept of instrumentality (Vogt, Koster & De Houwer, 2016).

Further, we found that attention was biased towards goal stimuli more than the simple action signals which were not associated with avoidance of negative outcomes. Both dysphoric and non-dysphoric individuals did not show any differences between standard and action-oriented neutral stimuli in disengagement from negative faces. However, both dysphoric and non-dysphoric individuals showed significant differences between disengagement of attention towards goal and towards action stimuli. These results provide evidence for the superiority of instrumental goal stimuli in prioritizing attention over negative emotional stimuli which were not associated with current avoidance goals. Further, our results show that mere action signals which are not associated with avoidance goals, do not reduce the attention bias for negative information

that is observed in dysphoric individuals. Therefore, it can be concluded that not the mere association to actions but the inclusion of goal-reinforced stimuli are necessary to modulate pre-existing biased attention processing of negative information in dysphoria, as observed in our study.

Our findings have both theoretical and clinical implications. In line with current models of attention in depression (De Raedt & Koster, 2010), attention bias for negative emotional information is seen as the rigid manifestation of activated individual self-schemas which guide dysphoric individuals' attention towards negative information in the environment. However, the findings from the current study suggest that manipulating the underlying avoidance motivation may result in the modulation of such attention bias to negative information. This conveys the notion that attention in depressogenic states can be transformed from a rigid prioritization of negative information to a flexible control of negative emotional material dependent upon goals. By this definition, our findings then provide support for predictions from motivational models of emotional attention, such that sustained attention to emotional information is guided by goals motivationally relevant to the current context (Pessoa & Adolphs, 2010; Okon-Singer, Lichtenstein-Vidne, & Cohen, 2013; Vogt, De Houwer, Crombez & Van Damme, 2013; Vromen, Lipp, & Remington, 2015).

However, we must address the lack of a significant interaction, suggesting that both groups followed a similar pattern of modulation of attention for negative stimuli by goals. All participants undergo disengagement from non-instrumental negative stimuli and shift towards non-instrumental neutral stimuli in one condition. In another condition, all participants undergo disengagement from non-instrumental negative stimuli and shift towards instrumental stimuli. It is through this within-group comparison between different conditions in dysphoric individuals,

we infer that disengagement is faster towards instrumental stimuli compared to non-instrumental neutral stimuli. But considering the high avoidance motivational value of aversive harsh sound in our sample, it is likely that the avoidance motivation induction was equally intense for both groups. Further, our findings in the non-dysphoric sample, although mimic the pattern of dysphoric individuals, are not surprising. Vogt et al. (2016) found evidence for a similar pattern of threat attention bias modulation by avoidance-oriented goals in a sample of healthy individuals. This finding in our non-dysphoric sample, taken together with the findings in healthy individuals in the study of Vogt et al. (2016), might indicate that a possible role of a positivity bias in guiding attention away from negative stimuli could also be at play particularly in the non-dysphoric individuals in our study. On the whole, our results provide support to the previous findings investigating the potential modulation of attention bias for threat by replicating the results pertaining to attention towards depressogenic stimuli in both dysphoric and non-dysphoric individuals.

Additionally, our findings also have practical implications. Current attention training procedures aimed at reducing depression-related attention biases for negative information tend to show limited success (Beard, Sawyer, & Hofmann, 2012; Cristea, Kok, & Cuijpers, 2015; Mogoșe, David, & Koster, 2014). An important drawback of these procedures is the exclusion of motivational components which could drive the attention processes. Based on our findings, future attention training procedures could incorporate avoidance goals to train attention away from negative stimuli. By manipulating the instrumentality of avoidance motivation, attention to negative information can be balanced across contexts. In a recent study it was found that rewards (music and earning money) can also be used to modulate attention away from negative stimuli in dysphoric individuals (Godara, Sanchez-Lopez, & De Raedt, 2019). Drawing on these results,

future training procedures could employ both reward approach and punishment avoidance components to modulate attention in a contextual manner, in order to improve adaptive, situation-specific emotional responding.

Despite the strengths of the study, some important limitations must be considered. The current study used a non-clinical sample of dysphoric and non-dysphoric individuals. However, it serves as a proof-of-concept showing that manipulating the instrumentality of avoidance motivation can lead to modulation of depression-related attention biases. Another sample-related limitation of the study concerns the gender imbalance and the average young age of the sample. The majority of the participants in the current study were women, and most were young college students. As such, future studies might benefit from the recruitment of a more gender-balanced sample in order to clarify the existence of gender-dependent differences, if any, in attention disengagement processes. Further, a more age-diverse sample can help clarify the differences between disengagement process over the course of the depressive disorder.

## **5. Conclusion**

Our findings suggest that avoidance goals can be used to modulate attention for negative emotional information in dysphoria, and in healthy non-dysphoric samples. These results support the integration of motivational factors in the study emotional attention in depression and indicate new ways to treat and develop training procedures to modulate negative attention biases that have a large impact in the onset and maintenance of depression.

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