Exploring the Relationship Between Attentional Bias Towards Threat and Symptoms of Adult Separation

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Purpose: Research has identified attentional bias towards threatening stimuli as a contributing factor to anxiety disorders, and treatment targeting this bias has been shown to reduce symptoms of anxiety (Azriel & Bar-Haim, 2020). Studies have found attentional bias to threats among children with separation anxiety disorder (SAD) when tested with dot-probe tasks, with a stronger bias seen when threats are disorder-congruent (Pergamin-Hight et al., 2015). No study has yet investigated this relationship among adults, despite growing recognition that separation anxiety is frequent in this population. Therefore, we investigated the relationship between SAD symptoms and attentional bias toward threatening stimuli (general and separation-specific) on a dot-probe task in a sample of adults, with the goal of informing targeted treatment for adult separation anxiety disorder (ASAD). **Methods:** Undergraduate participants ($n = 57$) completed a measure of ASAD symptom severity (ASA-27) and two versions of the dot-probe task, one with separation-specific threatening words and one with generally threatening words. Attentional bias was tested using detection latency. **Results:** Spearman's rho correlations between ASA-27 and separation-specific threat trials ($r_s = -.07$; $p = .62$) and general threat trials ($r_s = .07$; $p = .60$) were not significant. However, ASAD symptoms were correlated with reduced accuracy on trials following ASAD-specific threat words ($r_s = -.38$, $p = .004$), but not general threat words ($r_s = -.16$, $p = .22$). **Conclusions:** We did not find that ASAD symptoms related to attentional bias. However, individuals with more ASAD symptoms were less accurate on trials that involved ASAD-threat words, suggesting an emotional interference effect of disorder-specific threats on task performance.
Keywords: separation anxiety, attentional bias, interference effects

Separation anxiety disorder (SAD) is characterized by persistent and excessive distress or worry related to separation from home or significant attachment figures (American Psychiatric Association [APA], 2022). An attachment figure is often a parent when the disorder is present in a child, but when seen in adults, the figure may be a parent, partner, child, or spouse. Whether seen in a child or adult, symptoms can include fears about harm befalling the attachment figure, nightmares about separation, somatic complaints when separated, and a reluctance to leave the attachment figure even for short periods of time. In prior editions of the *Diagnostic and Statistical Manual of Mental Disorders (DSM)*, SAD was categorized under "Disorders First Diagnosed in Infancy, Childhood, or Adolescence" and included a required diagnostic criterion of onset prior to the age of 18 years old (APA, 1994). The 5th edition of the DSM (APA, 2013) removed this criterion and amended features of the disorder, reflecting the growing recognition that SAD frequently occurs among adults, which has been referred to in the literature as adult separation anxiety disorder (ASAD).

Empirical support for the notion of ASAD continues to grow, with data establishing high prevalence rates, high comorbidity with anxiety and mood disorders, and most notably, evidence of poor prognoses for those diagnosed (Manicavasagar & Silove, 2020; Shear et al., 2006). ASAD can be debilitating in a variety of functional areas, many of which can lead to long-term impairment (APA, 2022). For example, individuals may be unable to leave their homes out of fear of leaving their attachment figure during the day, or they may be unable to form or maintain healthy relationships due to the pervasive need to be with their attachment figure.

Given that SAD was formally seen as primarily a childhood disorder, the bulk of studies and treatment explorations surrounding SAD centers on children and adolescents (Bogels et al., 2013). Although SAD is characterized by the same symptoms in both children and adults, the attachment figure and the impairment in daily functioning differ between the two populations (APA, 2022). For example, a child with SAD might wish to stay home with their parent and therefore have poor school attendance. An adult with SAD may be unable to leave their spouse and therefore repeatedly miss work, leading to loss of employment. To date, very little research exists on ASAD, creating a gap in not only the understanding of the disorder's mechanisms, but also in the possibility of creating tailored treatments (Baldwin et al., 2016; Bogels et al., 2013).

A rich area of literature has investigated attentional bias towards threat as a prominent maintenance for many anxiety disorders, with a premise that modifying biases in attention may be foundational to anxiety disorder treatment (Barry et al., 2015). Attentional bias is the phenomenon of a person's attention being more

focused toward or away from a threatening stimulus in comparison to a neutral stimulus (Azriel & Bar-Haim, 2020). When an individual has an attentional bias towards a threat, they may excessively focus on potentially threatening stimuli, leading to heightened anxiety and distress. Having a bias to direct attention toward threats may result in difficulties with concentration, decision-making, and problem-solving. For example, an individual with ASAD may need to immediately check their phone after the arrival of every new notification, worried it may be about their loved one. This bias towards potential threats can distract from important duties or responsibilities and may impair daily functioning. Furthermore, by repeatedly attending to threatening cues, individuals may amplify and sustain their anxiety responses, causing heightened sensitivity towards potential threats and further reinforcing a cycle (Azriel & Bar-Haim, 2020).

The presence of attentional bias is often tested with a visual dot-probe task (Price et al., 2013). In this task, participants are presented with an emotionally neutral stimulus and an emotionally threatening stimulus, such as a neutral face and an angry face, on a computer monitor for a set display length of milliseconds (Bantin et al., 2016). A target probe, such as a dot or arrow, then appears behind either the neutral or threatening stimulus, and the participant is asked to identify the probe's shape or location by a key press or mouse click. Detection latency, the time from the target's arrival to the participant's detection of the target, as indicated by a key press or mouse click, is recorded for each trial. A shorter detection latency on trials in which the target is behind the threatening stimulus would indicate an attentional bias toward threatening stimuli. Specifically, decreased response latency to detect the probe when it is located behind a threatening word or image implies the person's attention was drawn to the area of the threatening stimulus compared to the neutral stimulus (Bantin et al., 2016).

Another task utilized to study the effect of threat cues on attention and information process is the emotional Stroop task, a modified version of the classic Stroop task, in which participants are asked to name the color of a shown word (Bar-Haim et al., 2007). In the original Stroop task, the presented word is either congruent with a color (such as the word "green" shown in the color green) or incongruent with a color (such as the word "green" shown in the color red). The emotional Stroop task displays words relating to threatening and neutral stimuli instead of the names of colors (i.e., *death* and *harm* instead of *blue* and *green*). A slower response to identifying the color of threatening words as compared to neutral words indicates biased processing of the threat. It is inferred that the participant is unable to focus exclusively on processing the color of the word as their attention is distracted by the presence of a threatening stimulus (Bar-Haim et al., 2007).

A meta-analysis conducted by Bair-Haim et al. (2007) examined 172 studies that tested attentional bias, most of which used either the dot-probe task or the emotional Stroop task. Overall, a significant attentional bias towards threat was found in anxious individuals and was absent in non-anxious individuals. Furthermore, no difference in threat bias was found when comparing results from studies that used the dot-probe task measure to studies that used the emotional Stroop task measure. Within analyses of the dot-probe task, attentional bias toward threat was found in trials that used pairs of faces as well as pairs of words, with no significant difference between the two stimuli. These results were shown to be true for both adult and child participants, with no significant difference between the two populations. Attentional bias was found in all anxiety disorders analyzed: panic disorder, post-traumatic stress disorder, social phobia (social anxiety disorder), and specific phobia (Bar-Haim et al., 2007).

SAD was not specifically analyzed as a discrete diagnostic category in Bar-Haim et al.'s (2007) meta-analysis, as research on the relationship between attentional bias and SAD was extremely limited. Only a handful of studies that examined attentional bias have included participants with SAD, all of which were conducted with children given the previous categorization of this disorder (Roy et al., 2008; Salum et al., 2013; Waters et al., 2014). However, given ASAD and SAD in children overlap in symptomatology, it is important to review the existing literature on SAD and attentional processes to better inform study design when researching this phenomenon in adults. To present an overview of the current literature regarding SAD and attentional bias, the results of these studies are summarized below.

In perhaps the largest SAD and attentional bias study, Roy et al. (2008) assessed attentional bias in 101 clinically anxious children, 59 of whom met the criteria for SAD. The study used a visual dot-probe task that showed pairs of angry/neutral and

happy/neutral faces and compared detection latency between a clinically anxious group and a non-anxious control group. Results indicated that clinically anxious children more quickly detected the probe located behind an angry face, suggesting an attentional bias toward threatening stimuli. Furthermore, no significant differences were found in attentional bias toward threat between anxiety disorders.

Another study analyzed the dot-probe task performance of 363 children in three disorder groups: fear-related, distress-related, and behavioral (Salum et al., 2013). The fear-related sample was comprised of 86 children, 30 of whom met the criteria for SAD. Of the three disorder groups, only the 'fear' group showed attentional bias directed away from the threat rather than toward the threat. This finding was explained through the theoretical lens of the fear versus distress structural model of emotional disorders. Anxiety disorders categorized by distress are more likely to result in hypervigilance toward threat, such as general anxiety disorder and post-traumatic stress disorder, whereas anxiety disorders categorized by fear (such as SAD and social phobia) would result in an avoidance of fearful stimuli and therefore a bias away from threat. In line with this model, this study found that high internalizing symptoms in the 'distress' group resulted in a greater bias towards threatening stimuli, whereas in the 'fear' group, high internalizing symptoms resulted in a greater bias away from threatening stimuli. A study conducted by Waters et al. (2014) found similar results among a sample of anxious children, some of whom had a primary diagnosis of SAD. Although these studies included children with SAD, results were presented in aggregate in which these participants were combined with those suffering from other anxiety disorders.

Importantly, the extant studies have not yet accounted for specific threat-related content for SAD. The dot-probe task and the emotional Stroop task can be conducted with general threatening stimuli or disorder-specific threatening stimuli (Pergamin-Hight et al., 2015). Specific threatening stimuli refer to pictures or words that are congruent to the disorder being analyzed, such as social-related words for social anxiety disorder. General threatening stimuli refer to pictures or words that are disorder-incongruent and related to an anxiety disorder different from that of the person being tested. To illustrate, for a person with SAD, generally threatening words might be dis-

ease and danger, and specific threatening words, or disorder-congruent words, might include "alone" and "abandoned", which have specific content relevant to the notion of separation from loved ones.

A recent meta-analysis examining attentional bias in youth and adults with measures including disorder-congruent threats versus disorder-incongruent threats found that clinically anxious participants displayed a larger bias toward disorder-congruent threats (Pergamin-Hight et al., 2015). The analysis included studies that used the emotional Stroop task as well as studies that used the dot-probe task, and effect sizes were combined to reach an overall effect of threat bias. When the combined effect sizes of the two tasks were compared, the difference between the two tasks was not statistically significant. This meta-analysis only included one study that examined attentional bias in participants with SAD (exclusively in children): a single study that found no evidence of attentional bias in general-threat trials or specific-threat trials (Kindt et al., 2003).

The primary takeaway from the literature available is ultimately that it has been scarce and inconclusive (Roy et al., 2008; Salum et al., 2013; Waters et al., 2014). Though meta-analyses have shown evidence for attentional bias toward threat in children and adults with various anxiety disorders, the limited number of studies involving participants with SAD has left the field with less than substantial answers regarding attentional processes in those with SAD. This is an important topic for study, as prior research has investigated attentional training as a treatment for other forms of anxiety, and therefore extending research on attention in ASAD might be used to develop new interventions for this condition.

Moreover, the studies discussed above were conducted with children; no studies have yet examined the role of attentional bias in adults with SAD. Though results have been mixed, the bulk of previous research has shown that children with SAD show an attentional bias in regard to threat, and adults with other anxiety disorders show an attentional bias toward threat, with a greater bias towards disorder-specific threat (Bar-Haim et al., 2007; Pergamin-Hight et al., 2015). Attentional bias has been shown to be a pivotal mechanism in maintaining anxiety disorders, and treatment targeting this bias has proven successful in reducing anxiety (Azriel & Bar-Haim, 2020; Hakamata et al., 2010). It is

reasonable to assume that ASAD, which overlaps considerably with SAD in children and is often comorbid with other anxiety disorders, might also be maintained by an attentional bias mechanism. Therefore, understanding attentional bias in ASAD is crucial to informing targeted treatment.

The present study aimed to address this important gap in the literature. We sought to determine if adults with greater levels of ASAD symptoms would also display greater attentional bias to threatening stimuli (general and disorder-specific) when tested with versions of the dot-probe task. We elected to use the dot-probe task to test this aim because, unlike the Stroop task, it is possible to measure if attentional bias is directed towards or away from threatening stimuli by calculating how long it takes for participants to detect the probe behind threatening words compared to neutral words (with a slower response indicating bias directed away from threat and a faster response indicating bias towards threat). Furthermore, we included trials with facial stimuli and trials with word stimuli to replicate the methods of past SAD and attentional bias studies (Roy et al., 2008; Salum et al., 2013; Waters et al., 2014), and to test both general threats and disorder-specific threats via word pairs. Based on previous research findings, it was hypothesized that higher ASAD symptom severity would correlate with greater attentional bias to threat, with a stronger bias toward threat in trials with disorder-relevant stimuli.

Methods

Participants

This study received approval from the Institutional Review Board (IRB) of Barnard College. All ethics guidelines were adhered to while conducting this study. Participants were given a written consent form to sign prior to beginning participation. Fifty-seven participants were recruited through Barnard College's Sona system. Each participant received laboratory credit for their Introduction to Psychology course after completing the study. The sample was 89% female and had a mean age of 18.92 years (SD = 0.98, range 18-21). The racial-ethnic composition was as follows: 55.9% non-Hispanic White, 5.1% African American, 6.8% Hispanic, 27.1% Asian/Pacific Islander, and 5.1% "other."

Measures

Adult Separation Anxiety Questionnaire (ASA-27): This 27-item questionnaire is used to determine ASAD symptom severity. Each item states a symptom or feature of ASAD and participants choose a response on a 4-point scale from 0, "this has never happened to me," to 3, "this happens very often" (Manicavasagar et al., 2003). Scores on the ASA-27 were treated as a continuous variable, with a higher score indicating greater symptoms of ASAD.

Dot-Probe Task: A plus sign was fixed in the center of a display to focus participants' attention. Emotionally neutral stimuli and emotionally threatening stimuli were then displayed on the screen in pairs. After 500ms, an arrow appeared behind either the neutral or threatening stimulus, and the participant was instructed to indicate which direction the arrow was pointing by clicking the corresponding mouse button (i.e., right-click for a right-pointing arrow). Detection latency was then recorded, with a shorter detection latency on threatening trials indicating an attentional bias toward threatening stimuli (MacLeod et al., 1986). The following three versions of the dot-probe task were administered:

1) Facial Stimuli: A pair of faces were displayed on the screen for 500ms. Pairs either depicted two happy faces, or an angry face and a happy face. 30 pairs were displayed in total; 15 pairs contained only happy faces and 15 pairs contained an angry face. The faces shown were black-and-white pictures of White men and women; the stimuli were not altered based on the gender or racial appearance of the participants.

2) General Threat Word Stimuli: A pair of words were displayed on the screen for 500ms (see Fig. 1). On threatening trials, one word was neutral (i.e., signature), and one word was a randomly selected generally threatening word (i.e., strangled). 30 pairs were displayed in total; 15 pairs contained only neutral words and 15 pairs contained a generally threatening word (see Table 1 for examples).

3) Specific Threat Word Stimuli: A pair of words were displayed on the screen for 500ms (see Fig. 1). On threatening trials, one word was neutral (i.e., hotel), and one word was a randomly selected specifically threatening word (i.e., alone). 30 pairs were displayed in total; 15 pairs contained only neutral words and 15 pairs contained a specifically threatening word (see Table 1 for examples).

Procedure

The design of this study was cross-sectional. After signing a written consent form, each participant was seated at a desk in a quiet laboratory testing room and asked to complete an online survey which included a demographics section inquiring about gender, age, race, and ethnicity, and the ASA-27 questionnaire. Upon finishing

the surveys, participants completed three dot-probe tasks: one consisting of facial pairs, one consisting of general threat words and neutral words, and one consisting of specific threat words and neutral words. For each trial, words and faces were displayed in a randomized order to reduce bias. After completing all study measures, participants were debriefed.

Statistical Analysis

Each participant's total score on the ASA-27 (ASATotal) was calculated, as well as any attentional bias toward threatening faces, specifically threatening words (i.e., ASAD-congruent words), or generally threatening words. To calculate attentional bias for each type of threat (FacialThreatBias, SpecificThreatBias, GeneralThreatBias), reaction time on trials during which the target followed an angry face, specifically threatening word, or generally threatening word (threat trials) was subtracted from reaction time on trials during which the target followed a neutral word (neutral trials). Due to the presence of outlier responses on the ASA-27, Spearman's rho was used to test for associations between ASATotal and threat bias on all tasks. Within-subject accuracy between Specific Word task threat trials and Specific Word task neutral trials, and between General Word task threat trials and General Word task neutral trials, was calculated by subtracting accuracy on threat trials from accuracy on neutral trials and was then correlated with participants' total score on the ASA-27 using Spearman's rho.

Results

The sample mean on the ASA-27 (M = 12.93, SD = 7.82) was similar to that reported in other undergraduate samples, while the observed range (minimum = 1, maximum = 33) indicated a sufficient range of ASAD symptom severity to consider this variable as a continuous marker of ASAD symptoms. No significant correlations were found between ASATotal and GeneralThreatBias (r_s = .07; p = .60), between ASATotal and SpecificThreatBias (r_s = -.07; p = .62), or between ASATotal and FacialThreatBias (r_s = .12, p = .37).

Average accuracy at detecting the arrow direction on all trials within the Specific Word task and the General Word task was high (see Table 2 for individual task accuracy percentages). To determine whether participants might be less accurate on trials that contained threatening stimuli (as compared to neutral-only trials) which would represent a marker

of emotional interference effects, we calculated intra-individual difference scores in accuracy for these trial types by subtracting accuracy on threat trials from accuracy on neutral trials. The within-subject difference in accuracy, as calculated, was then correlated with participants' total score on the ASA-27. Spearman's rho showed a weak to moderate negative correlation between differences in accuracy on Specific Word task trials and total score on the ASA-27 (r_s = -.38, p = .004), which was statistically significant. In contrast, there was no relationship between ASAD symptoms and the difference in accuracy comparing trials involving general threat words to neutral words as there was no significant correlation found between the difference in accuracy on General Word task trials and total score on the ASA-27 (r_s = -.16, p = .22).

Discussion

This study sought to determine if adults with greater levels of ASAD symptoms would also display greater attentional bias to threatening stimuli (general and separation-specific). The hypothesis that those who score higher on a measure of ASAD would have a greater attentional bias toward specifically threatening words was not supported, as the correlations between reaction time on dot-probe tasks and total scores on the ASA-27 were not significant. However, the significant correlation between difference in accuracy on Specific Word task trials and total score on the ASA-27 indicates that participants with higher levels of ASAD symptoms had a greater reduction in accuracy on separation-specific threat trials than on neutral trials. This reduction in accuracy would suggest that seeing the words related to separation caused impaired accuracy in identifying the target, possibly an emotional interference effect specific to words related to separation that did not extend to general threat.

One possible explanation for these results is the vigilance-avoidance theory of attentional bias (In-Albon et al., 2010). The vigilance-avoidance theory of attention theorizes that anxious individuals may initially be vigilant towards threat in their surroundings, but upon detecting threat, subsequently avoid the threat and divert attention away from it. In-Albon et al. (2010) found that in the first 1000ms of a task, both anxious and non-anxious participants gazed at threatening images and neutral images for a similar length of time, but after 1000ms, anxious participants gazed at

threatening images longer than at the neutral images. After 3000ms, anxious participants gazed at threatening images for a shorter duration than they did the neutral images, indicating that within the duration of 1000ms to 3000ms anxious individuals may be vigilant toward threat before subsequently disengaging from the threat and avoiding it. The display duration of the dot-probe task word pairs used in this study was 500ms, which may have been too short a duration to assess attentional bias away from threat. If the display duration was longer than 1000ms, it is possible that vigilance toward threatening words would have been seen.

Though the original hypothesis of this paper was not supported by the results, there was a significant correlation between a reduction in accuracy on the dot-probe tasks and ASAD symptom levels. Participants who scored higher on the ASA-27 performed less accurately on trials that included an ASAD-specific threat rather than a general threat. Based on these results, we hypothesize that ASAD-specific threats may have led to an emotional trigger that resulted in poorer task performance. However, it is important to note that these findings are correlational, and additional research is needed to further understand the nature of this relationship and any potential causal factors involved.

Limitations of this study included a small sample size, a limited participant age range of 18-21, and using convenience sampling to recruit participants, which may have resulted in bias. This was a non-clinical sample, and therefore all results are based on ASAD symptom levels rather than a clinical diagnosis. Furthermore, we recognize a major limitation in the fact that we did not screen participants for any comorbid disorders, and it is possible that subjects had co-occurring anxiety disorders. Another limitation was including only one length of our dot-probe task trials, which as discussed above, may have impacted our findings. In addition, our facial stimuli were limited and did not include images from all racial-ethnic groups. Future studies should seek to investigate the role of attentional bias in a large population of adults with varying ages and a primary diagnosis of ASAD, as a greater sample size and clinical sample are both necessary to replicate and extend these findings. This study was also limited by its correlational design; future studies should investigate this topic with experimental approaches.

Additionally, testing the use of dot-probe tasks with varying display duration could provide addition-al understanding of how attentional bias operates in ASAD and provide insight into what specific factors may impede cognitive processes. For example, dot-probe tasks with a duration greater than 3000ms on trials may show an attentional bias towards specific threats but not general threats. Results of the current study suggest that there may be a negative effect of disorder-specific threats on task performance, which should be further researched due to its possible applications, such as informing treatment. For instance, in work settings, individuals with ASAD may struggle to perform well on tasks when exposed to stimuli related to their separation anxiety, such as reminders of separation from attachment figures. This can affect job performance and overall success. Through cognitive restructuring and attentional training exercises, individuals can learn to redirect their attention away from threat cues and develop more adaptive coping strategies (Hakamata et al., 2010). This highlights the importance of considering disorder-specific threats and attentional biases in the assessment and treatment planning for ASAD, enhancing the effectiveness of interventions and improving overall outcomes for individuals experiencing separation anxiety. Researchers might test the effects of ASAD-specific threat words in a clinical sample on various tasks, including the Stroop task which has been previously used to assess emotional interference effects. Future work could also investigate if disorder-specific triggers affect task performance in those with other anxiety disorders in the same manner.

Conclusion

This study examined attentional bias in a sample of adults, some of whom experienced symptoms of ASAD, using the dot-probe task. The aim was to elucidate the relationship between these two variables and inform the creation of targeted treatment. Although the initial hypothesis that higher ASAD symptom severity would correlate with greater attentional bias toward threatening stimuli was not supported, there was a significant correlation between ASAD symptom levels and reduced accuracy in trials involving ASAD-specific threat words. These results suggest that there may be emotional interference occurring in ASAD-specific threat trials which affects task performance. However, this study's findings were correlational, and additional research is needed to better understand the relationship and mechanisms.
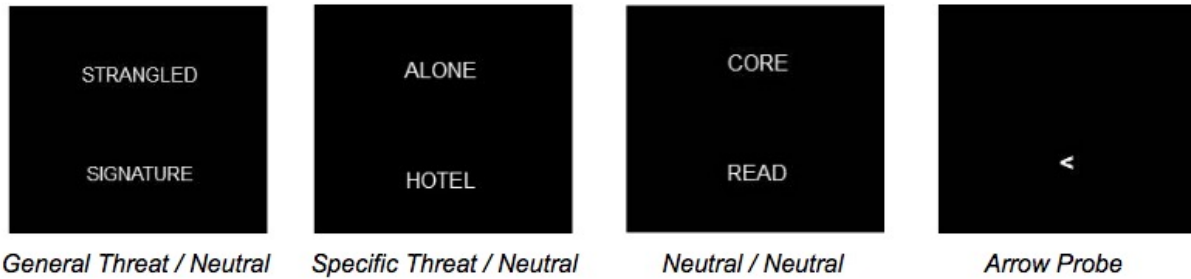
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Figure 1

Examples of the Dot-Probe Tasks' Displays

STRANGLED	ALONE	CORE	
SIGNATURE	HOTEL	READ	<
General Threat / Neutral	Specific Threat / Neutral	Neutral / Neutral	Arrow Probe

Note. This figure provides examples of how word pairs were displayed in the General Threat Word dot-probe task and the Specific Threat Word dot-probe task, as well as the arrow probe used in all trials.

Table 1

Examples of Word Pairs Used in the Dot-Probe Tasks

General Threat – Neutral	Neutral – Neutral	Specific Threat – Neutral
Anxiety – Journal	Pat – Via	Abandoned – Sheltered
Danger – League	Campus – Confer	Alone – Hotel
Afraid – Detail	Shearing – Textured	Lonely – Fabric
Disease – Remarks	Scans – Tract	Unaccompanied – Thermometers
Terror – Pupils	Fitted – Midway	Companionless – Sentimentally
Fear – Note	Core – Read	Deserted – Icebox
Worry – Inner	Fireplace – Reclaimed	Solitary – Whistle
Harm – Pond	Cleaners – Hallmark	Unescorted – Appliances

Table 2

Mean Percentage of Accurate Responses

Trial Type	Mean Percentage of Accurate Responses
Specific Word Task Threat Trials	94.65%
Specific Word Task Neutral Trials	94.98%
General Word Task Threat Trials	94.70%
General Word Task Neutral Trials	94.62%

Note. This table displays the mean percentage of accurate responses in indicating the direction of the arrow probe on four trial types.