ATTENTION BIASES AND SOCIAL SKILLS IN YOUTH WITH ANXIETY

By

Hailey Vivian Burns

Submitted in partial fulfilment of the requirements
For the degree of Master of Science

At

Dalhousie University
Halifax, Nova Scotia
July 2023

Dalhousie University is located in Mi'kma'ki, the
ancestral and unceded territory of the Mi'kmaq.
We are all Treaty people.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Background: While attentional biases towards negative stimuli have previously been linked to the development and maintenance of anxiety disorders, attentional biases in anxiety remain understudied using dynamic social videos. Moreover, while many have proposed that negative attentional biases may lower the ability to be successful in social situations, the cognitive mechanisms behind the links between anxiety, attentional bias, and interpersonal competence remain unclear.

Objective: The purposes of this study were to use modern eye-tracking equipment and novel dynamic stimuli to further investigate negative attentional biases in emerging adults with anxiety, and to examine links with social competence.

Methods: Non-clinical participants (N = 62; mean age = 20.44 years) were recruited and completed validated questionnaires regarding their anxiety symptoms and interpersonal competence in this cross-sectional study. Participants then completed a free-viewing task on a desktop computer. The procedure involved viewing 30-second video clips from TV shows and movies while having their eye movements tracked using the Eyelink 1000 Plus. The video clips were shown in pairs depending on their emotional content (i.e., positive-neutral, negative-neutral, and positive-negative) on a split screen without audio. Time to first fixation, dwell time, and the number of fixations were used as outcome variables in separate linear mixed-effect models to determine the effect of anxiety and pairing type on attentional biases. Significant interactions were then probed further and stratified by pairings to assess attentional biases within each pairing combination.

Results: Overall, participants fixated more quickly on emotional videos (i.e., positive and negative) over neutral ones, with anxious participants orienting their gaze faster to the videos, regardless of content, in comparison to their healthy peers. Moreover, as anxiety symptoms increased, time spent gazing at negative videos increased in negative-neutral pairings, highlighting that emerging adults with increased anxiety symptoms may show a negative attention bias when viewing social interactions. Interestingly, this effect was not present when they were shown positive-negative pairings. In general, emerging adults spent more time gazing at positive videos over neutral videos in positive-neutral pairings, and this was not moderated by anxiety level. Lastly, the relationship between anxiety and lower interpersonal competence was not mediated by negative attentional biases.

Conclusions: Our results demonstrate that social videos are feasible stimuli in attention research and should be considered for future studies since they are more reflective of real-life scenarios. Lastly, this research lays the foundation to directly help emerging adults by guiding therapeutic techniques, such as attentional bias modification training tasks, that may help those suffering from anxiety.

LIST OF ABBREVIATIONS USED

CBT	Cognitive Behavioural Therapy
GAD	Generalized Anxiety Disorder
ms	Millisecond
mm	Millimeter
SD	Standard Deviation
N	Number of Participants
SES	Socioeconomic Status
ABM	Attention Bias Modification
REDCap	Research Electronic Data Capture
IWK	Izaak Walton Killam Hospital for Children
SCARED	Screen for Child Anxiety Related Disorders
SCAARED	Screen for Adult Anxiety Related Disorders
ICQ-15	Interpersonal Competence Questionnaire (Brief Form)
Hz	Hertz
US	United States
PC	Personal Computer

ACKNOWLEDGEMENTS

I would first like to thank my co-supervisors: Drs. Sandra Meier and Raymond Klein. Sandra, thank you for your constant guidance, support, and expertise around a topic I knew relatively little about when I first started this project. Our weekly meetings were invaluable, and I will be forever thankful that I was fortunate enough to have you as one of my co-supervisors. Ray, I would like to thank you for the interesting papers you send, as well as your insightful questions and suggestions surrounding the eye-tracking setup. Without you, this project would not have gone as smoothly as it did. A big thank you to my committee members, Drs. Jose Mejia and Sherry Stewart, who provided helpful advice and were as excited about the project as I was.

I would like to personally thank all my participants for their time, interest, and enthusiasm for my study. I would also like to express my gratitude towards Austin Hurst, who taught me more about coding eye-trackers than I ever thought possible. This project would not have gotten off the ground without your insane coding skills (I still have no idea how you do it!).

To Haley Bernusky, Temi Toba-Oluboka, and Tulayla Katmeh: I am so thankful that we met in this program and that I can call each of you my friend. There are no words to express how much I appreciated your unwavering support and kindness throughout the year.

Lastly, I would like to thank my family. Cameron: thank you for trying to recruit participants for my study even though I refused to pay you for your time. Tyler: thanks for pretending to listen when I explained to you what I was studying. Finally, to Mom and Dad: thank you for being by my side and for answering the phone (most of the time). Most importantly, thank you for believing I am always capable of more.

CHAPTER 1. GENERAL INTRODUCTION

1.1. Anxiety

Anxiety disorders are chronic and disabling conditions, and one of the most common psychiatric disorders in society today (Baxter et al., 2013; GBD 2019 Diseases and Injuries Collaborators, 2020; Global Burden of Disease [GBD] 2019 Mental Disorders Collaborators, 2022; Kessler, Chiu, et al., 2005). Anxiety disorders can be characterized by extensive fear, worry, and/or tension that is/are accompanied by various physical symptoms, such as rapid heart rate, trembling, restlessness, and/or muscle tension (Crocq, 2017; Gale & Oakley-Browne, 2000). In 2019, it was estimated that 301 million people worldwide were currently living with an anxiety disorder, ultimately causing significant impacts on numerous individuals' physical and mental well-being (World Health Organization, 2022b). In Canada, it is estimated that 1 in 10 individuals are affected by one or more anxiety disorders (Health Canada, 2009). Concerningly, of the Canadian provinces, Nova Scotia has been reported to have the highest age-standardized prevalence of health services utilization to assist with various emotional (i.e., mood and anxiety) disorders (McRae et al., 2016).

Further, since 2020 and after the onset of the coronavirus pandemic, the number of people living with an anxiety disorder has increased by a whopping 25.6%, resulting in an additional 76.2 million cases of anxiety worldwide (COVID-19 Mental Disorders Collaborators, 2021; Daniali et al., 2023). Similar statistics were found for Canada, as the prevalence of generalized anxiety disorder continued to increase during the pandemic from 13% during the fall of 2020 to 15% in the spring of 2021 (Statistics Canada, 2021).

Similarly, affecting around 11.6% of youth[1] today, anxiety disorders are the most common emotional disorder in youth, with the prevalence continuing to rise (Racine et al., 2021; Tiirikainen et al., 2019). Previous reviews and meta-analyses have shown that the average age of onset for most anxiety disorders ranges from early adolescence to emerging adulthood (Beesdo et al., 2009; Lijster et al., 2017; Solmi et al., 2022), eventually leading to an increased risk of developing future psychiatric conditions, as well as impaired psychosocial outcomes later in life (Essau et al., 2014; Hill et al., 2016). More specifically, anxiety disorders in childhood have been shown to predict comorbidities such as depression, substance abuse, and suicidal thoughts and/or behaviours (Bittner et al., 2007; Cohen et al., 2018; Hill et al., 2016; O'Neil Rodriguez & Kendall, 2014).

1.1.1. Anxiety in Females

Gender and sex differences have also been found in youth with anxiety. Previous studies have found that youth who report higher levels of femininity show an increase in anxiety symptoms in comparison to those who report high levels of masculinity (Carter et al., 2011). Further, women typically have higher rates of lifetime diagnoses of anxiety disorders (McLean et al., 2011), including an increased risk of social anxiety (Asher & Aderka, 2018; Gao et al., 2020; Xu et al., 2012). Unfortunately, girls are also more likely than boys to display higher rates of feared social situations, situational panic attacks, and have moderate to high initial anxiety symptom severity (Ohannessian et al., 2017; Xu et al., 2012). Taking this information into consideration, it is important to promote early intervention, recognition, and treatment of anxiety (Wehry et al., 2015), especially in young women.

[1] Previous research has suggested that "youth" are between the ages of 15-24 (Masquelier et al., 2021), with "emerging adulthood" occurring between the ages of 18-25 (Arnett 2000). For the study presented in this thesis, "youth" were defined as those between the ages of 18-24.

1.1.2. Anxiety: Causes and Treatments

Genetics, gender, adverse life events, family history, and social media are all factors that have previously been studied to help determine among whom anxiety disorders are most likely to emerge (Bystritsky et al., 2013; Keles et al., 2020; Murray et al., 2009). Importantly, a lack of social support (in-person or online) is a key factor in the development and maintenance of emotional problems (e.g., anxiety) and impairments in social skills (Demir et al., 2012; Nangle et al., 2003; Ozbay et al., 2007; Ranta et al., 2016). Moreover, not only have youth with low social support and high social isolation been shown to develop anxiety, but they also experience poorer overall mental well-being (Lin et al., 2018; Nangle et al., 2003). Further, youth experiencing emotional problems like anxiety have also been shown to withdraw from social interactions, ultimately leading to a vicious cycle between social isolation and anxiety where both problems maintain or even exacerbate one another (Allen & Badcock, 2003).

Currently, practice recommendations for anxiety assessment include screening for potential anxiety symptoms that differentiate from typical developmental worries, rating the severity of symptoms, as well as assessing functional impairment, general medical conditions that may have similar symptoms to anxiety, and evaluating potential co-morbid psychiatric conditions (Connolly et al., 2007; Wehry et al., 2015). Various psychological treatments, such as cognitive behavioural therapy (CBT) and pharmacological medications, have previously been shown to be effective in the treatment of anxiety in children, youth, and adults (DiMauro et al., 2013; Kodal et al., 2018; Walter et al., 2020; Wehry et al., 2015; Whiteside et al., 2020). However, significant side effects have been reported for anxiety medications in youth, such as difficulty sleeping, tremors, fatigue, and nausea (Creswell et al., 2020; Z. Wang et al., 2017). Further, previous research has reported that up to 50% of youth with anxiety disorders do not

respond to CBT (Higa-McMillan et al., 2016; Pettit et al., 2020; Silverman et al., 2008). Consequently, it is imperative to investigate new therapeutic techniques that may be used in conjunction with more classical treatments to better help youth manage their anxiety.

1.2. Attention

Attentional processes involve alerting, orienting, and executive function (Petersen & Posner, 2012). The alerting network involves not only achieving an alert state but also the maintenance of an alert state for information processing (Mullane et al., 2016; Posner & Rothbart, 2007). Orienting involves shifting one's focus of attention towards a specific location or object in space (Mullane et al., 2016; Posner & Rothbart, 2007; Roelofs & Piai, 2011). Lastly, executive control involves the voluntary control of attention to managing one's cognitive load for planning and execution of behaviours (Geva et al., 2013; Mullane et al., 2016; Posner & Rothbart, 2007). Current research based on cognitive models of anxiety suggests that attentional impairments and biases could potentially lead to the development and/or maintenance of anxiety disorders (Bar-Haim et al., 2007; Beck & Clark, 1997; Dudeney et al., 2015; Eysenck et al., 2007). In particular, those with anxiety have been shown to present deficits and impairments in the orienting network (Heeren, Maurage, et al., 2015). Further, maladaptive attentional biases, such as difficulty disengaging from negative stimuli, may lead to hyperarousal and attentional avoidance – potentially creating a cascade of emotional problems, such as anxiety, later in life (Shechner et al., 2013).

1.3. How to Measure Attention

Response time measures, such as the emotional Stroop task (Clauss et al., 2022), are one of the main methods used to assess for attentional biases. During the emotional Stroop task, words or photos are presented to the participant using different coloured fonts or overlays (Ben-

Haim et al., 2016). The words chosen either represent negative words (e.g., DEATH, SHAME) or neutral words (e.g., CHAIR, TABLE) while the photos might depict negative (e.g., angry, sad, anxious), neutral, or positive (e.g., happy) facial expressions. Generally, participants are asked to name the colour of the font or overlay as quickly and accurately as possible. Those who are more anxious typically display slower colour-naming response times to threatening words or photos as they may be distracted by the content (Becker et al., 2001; Suárez-Pellicioni et al., 2015; Williams et al., 1996). In addition, visual search tasks are also common in attention research. For visual search tasks, participants are required to find a certain target (e.g., a happy or angry face) in a clustered environment as quickly as possible (Hu et al., 2021). A negative attention bias occurs when participants correctly locate threatening pictures faster than non-threatening stimuli (McNally, 2019).

Many studies investigating attentional biases use the dot-probe task (Roy et al., 2008; Thigpen et al., 2018). The dot-probe task involves showing two stimuli or cues simultaneously before replacing one of them with a probe. Participants are instructed to focus on a central fixation point during the stimulus presentation before orienting to the probe as quickly as possible (Thigpen et al., 2018). Threat and/or negative cues are generally paired with neutral stimuli, with quicker response times towards probes replacing negative than neutral cues being considered reflective of threat-related attentional biases (Thigpen et al., 2018).

Despite the popularity of these tasks, data from reaction-time based tasks in youth samples display more variation in comparison to adult samples, potentially due to methodological differences (Lisk et al., 2020). For example, longer stimuli presentations may be required to permit processing in younger vs. older samples (Dudeney et al., 2015; Lisk et al., 2020). Further, the reaction and latency times do not take into account motor response variations

between children, youth, and adults which can also impact the reaction-based tasks (Dudeney et al., 2015; Lisk et al., 2020). Being heavily task-dependent, the dot-probe task may also cause fatigue and consequent response errors in youth (Lisk et al., 2020). Most importantly, the dot-probe task, as well as other popular reaction time-based attention tasks, such as the emotional Stroop task or Visual Search task, are limited to assessing only the latencies of responses to various stimuli, not taking into account the actual amount of attention or attentional shifts individuals may display when viewing a stimulus (Jiang & Vartanian, 2018).

Given these limitations, alternative approaches have been developed, such as those using eye-tracking software. In particular, modern eye-tracking equipment allows researchers to continuously measure a participant's gaze, as well as investigate other parameters and behaviours, such as pupil size, saccade patterns, speed of saccades, number of fixations, time to first fixation on a stimulus, and dwell time on certain areas of a stimulus, to further investigate attentional biases (Jiang & Vartanian, 2018). This may allow for further discrimination between the early and late stages of attentional processes (Wieser et al., 2009). Many eye-tracking studies have also employed "free-viewing" tasks that may be more appropriate for youth as they are less dependent on task performance and more generalizable to real-life scenarios (Lisk et al., 2020). In free viewing experiments, participants are instructed to look at stimuli wherever they wish in order to obtain data regarding potential biases that are more naturalistic (Clauss et al., 2022; Roy-Charland et al., 2017).

1.4. Negative Attentional Biases

During childhood, developing the ability to orient and control one's attention is essential to select relevant internal and external cues in order to appropriately respond to various circumstances and situations (Posner & Rothbart, 2000; G. D. Reynolds & Roth, 2018). Negative

attentional biases have previously been found as early as infancy (LoBue & DeLoache, 2010; Nakagawa & Sukigara, 2012) suggesting a strong innate component.

Reaction Time Studies

A study conducted by LoBue and DeLoache (2010) used manually coded videos to assess whether infants detect threat-related stimuli quickly (LoBue & DeLoache, 2010). When viewing pairs of pictures side by side on the screen (i.e., snakes + flowers and angry + happy face), infants, aged 8 to 14 months, fixated more quickly towards photos of snakes and static images of angry human faces in comparison to flowers or happy faces, respectively (LoBue & DeLoache, 2010). Similar results were also found in infants ranging from 4 – 24 months (LoBue et al., 2017). Using a modified version of the dot-probe task with a longer stimulus duration, infants ranging in age from 4 months to 24 months all fixated more quickly and fixated first more often on photos of snakes more so than frogs, suggesting that attentional biases towards certain threatening stimuli, such as snakes, might be stable across infancy (LoBue et al., 2017).

Eye-Tracking Studies

Aktar et al. (2022) also found similar results with a free-viewing task using eye-tracking technology. After creating videos (1500 ms duration) depicting neutral, happy, fearful, sad, and angry facial expressions, Aktar et al. (2022) had infants, ranging in age from 5-19 months, along with their parents, watch each video while having their gaze tracked. Interestingly, while they found that parents spent longer dwelling on angry faces over happy ones, the infants displayed an avoidant pattern in which they had longer dwell times on happy faces over angry ones (Aktar et al., 2022). The opposite patterns of attention shown by the infants in comparison to the parents may be attributed to infants having more experience with happy faces in comparison to threat-related faces in their day-to-day lives, as well as developmental differences (Aktar et al., 2022).

While the detection and scanning of potential threats in the environment are imperative for survival, some individuals display an exaggerated sensitivity towards irrelevant, negative, or threat-related stimuli in the environment, ultimately leading to maladaptive attentional biases and an increase in emotional problems (Lisk et al., 2020; White et al., 2009). Importantly, threat-related attentional biases may enhance emotional problems by providing individuals with a false perception of threats, both environmental and social, which in turn creates a cyclic mechanism where their attentional bias towards threat-related stimuli further increases feelings of anxiety and vice versa (Burris et al., 2019; Morales et al., 2016; Pérez-Edgar et al., 2014).

1.4.1. Negative Attentional Biases in Adults

While some evidence suggests infants display a bias towards or away from threat-related stimuli, it is well known that anxious adults display an attentional bias *towards* negative and/or threatening stimuli (Dudeney et al., 2015). In an influential meta-analysis of 172 studies, Bar-Haim et al. (2007) found that anxious individuals showed a significant threat-related bias that is not seen in non-anxious individuals.

Emotional Stroop Task Studies

Numerous studies have found that those with greater anxiety symptoms display attentional biases on the emotional Stroop task (Bar-Haim et al., 2007; Becker et al., 2001; Cisler & Koster, 2010). For example, an early study by Becker et al. (2001) investigated attentional biases in those with generalized anxiety disorder (GAD) and social phobia, as well as control participants (Becker et al., 2001). Participants were asked to name the colour of the font on cards that displayed either control colour words (e.g., “blue, “green”), GAD-related words (e.g., “death”, nervous”), speech-related words (e.g., “talk”, “audience”), positive words (e.g., “flower”, “sunset”), or neutral words (e.g., “chair”, “locker”). They found that GAD participants

had slower times towards the GAD-relevant words in comparison to social phobia and control participants; the GAD participants also took longer for the speech-related words than the healthy controls (Becker et al., 2001). In comparison, those with social phobia only exhibited a slower naming time than the healthy control participants for the speech-related words (Becker et al., 2001).

Dot-Probe Task Studies

Negative attentional biases have also been found in the adult population using the dot-probe task (Bar-Haim et al., 2007; Cisler & Koster, 2010; Mogg & Bradley, 1998). In a recent meta-analysis regarding facial dot-probe tasks, socially anxious individuals were found to allocate more attention towards threatening faces compared to non-anxious individuals (Bantin et al., 2016). Further, both older and younger adults have been shown to display a bias towards negative faces in neutral-negative pairings when performing the dot-probe task. However, younger adults also appear to display a negative attentional bias when shown negative-positive pairings while older adults lacked an attention bias in this pairing (Tomaszczyk & Fernandes, 2014). These results suggest that, while both older and younger adults may display a negative attention bias, this bias may be amplified in the younger adult population (Tomaszczyk & Fernandes, 2014).

Eye-Tracking Studies

Anxious adults have also been shown to display vigilance for threats in eye-tracking studies in comparison to controls (Armstrong & Olatunji, 2012). For example, Buckner et al. (2010) performed a free-viewing task in which participants were asked to "look naturally at the screen." Participants viewed four pictures for 2000 ms on a computer screen that consisted of three non-human images (e.g., buildings, nature scenes) and one facial image (expressions

included disgust and happiness) (Buckner et al., 2010). To assess disengagement from the stimuli, the authors created time blocks of 500 ms (out of a total of 2000 ms) and calculated the proportion of fixation time on the face pictures relative to the total fixation time for each time block. They found that individuals with high social anxiety had difficulty disengaging away from disgusted faces, but not happy faces or the non-facial images (Buckner et al., 2010).

In the current literature, studies using eye-tracking technology also use the dot-probe paradigm for their experimental designs. More specifically, as eye movements are faster and a more direct method to assess attention over manual responses (Veerapa et al., 2020), eye-tracking technology is becoming more popular in measuring attention while conducting the dot-probe task. For example, Veerapa et al. (2020) used the dot-probe task and eye-tracking technology to investigate the effect of trait anxiety on negative attentional biases. Participants were asked to view two stimuli simultaneously – one neutral scene (e.g., pictures associated with inanimate objects) and one negative scene (e.g., images associated with being injured) – for a duration of one or two seconds on a computer screen. They found that as trait anxiety increased, so did dwell time on the negative pictures (Veerapa et al., 2020).

1.4.2. Negative Attentional Biases in Youth

Such negative attentional biases have also been found in severely anxious youth (Roy et al., 2008; Waters et al., 2010). However, mixed results have suggested that the cognitive mechanisms behind attention biases may not be as clear in the youth population as in adults (Dudeney et al., 2015; Roy et al., 2015).

Emotional Stroop Task Studies

A recent meta-analysis found that youth with greater anxiety severity display a significant threat-related attentional bias on the emotional Stroop task compared to their healthy peers

(Dudeney et al., 2015). For example, a study using a modified version of the emotional Stroop task had youth, aged 6-12, view facial images with the outline being red, blue, green, or yellow (Hadwin et al., 2009). Participants were asked to click a certain button depending on the colour of the outline. Results were consistent with adult research, highlighting that elevated social concerns, measured through the Revised Children's Manifest Anxiety Scale (C. R. Reynolds & Richmond, 1985), were associated with slower reaction times (i.e., attentional interference) in response to angry faces (Hadwin et al., 2009).

Dot-Probe Task Studies

A study using the dot-probe task conducted by Roy et el. (2008) investigated attentional biases in 101 youth between the ages of 7 – 18, both with and without an anxiety disorder (Roy et al., 2008). Roy et al. (2008) had their participants view either angry-neutral or happy-neutral pairings for 500 ms before a probe was displayed in the location of one of the images (Roy et al., 2008). Overall, they found that anxious youth fixated faster on angry human faces over neutral photos (Roy et al., 2008), suggesting anxious children, adolescents, and youth may display an initial vigilance towards threatening stimuli.

A study conducted by Waters et al. (2010) followed a similar design. They recruited children, aged 8-12 years, to view face pairings of angry-neutral, happy-neutral, and neutral-neutral for 500 ms per trial (Waters et al., 2010). They found that children who reported higher levels of anxiety showed a significant attentional bias towards angry faces (Waters et al., 2010). Interestingly, the study separated the anxiety group into high clinical anxiety and those with low clinical anxiety. Youth with high clinical anxiety displayed an attentional bias towards angry faces that was significantly different from the low clinical anxiety group and the control group, highlighting that those with high clinical anxiety may have an increased bias towards negative

stimuli that is not present in the low clinical anxiety group or the healthy controls (Waters et al., 2010).

A recent meta-analysis emphasizes these findings, with anxious youth displaying a significant bias towards threat-related stimuli; however, healthy children were also found to display a negative attention bias, merely to a lesser extent (Dudeney et al., 2015). This suggests that attention bias research in children, compared to adults, may be inconsistent due to potential developmental differences, highlighting the importance of studying attentional biases in youth independent of adult research (Puliafico & Kendall, 2006; Rosen et al., 2019).

While the meta-analysis conducted by Dudeney et al. (2015) mentioned above found differences in attentional biases between anxious and non-anxious children using the emotional Stroop task, the same results were not found for the dot-probe task (Dudeney et al., 2015). This further differs from adult research, which found evidence for threat-related biases with both the emotional Stroop task and the dot-probe task in anxious and non-anxious individuals (Bar-Haim et al., 2007). This may be due to the dot-probe task being initially designed for adults, as well as potential fatigue and measurement errors that are more common in youth (Dudeney et al., 2015).

Eye-Tracking Studies

Eye-tracking studies further emphasise that anxious youth may have a negative attentional bias (Shechner et al., 2013). For example, Shechner and colleagues (2013) showed fifty face pairs (angry-neutral, happy-neutral, and neutral-neutral) for ten seconds each to anxious and non-anxious youth under free-viewing conditions. Overall, they found that anxious youth displayed vigilance towards angry faces as they were more likely to direct initial attention and have a shorter latency to fixate towards angry faces in comparison to neutral (Shechner et al., 2013). However, anxiety severity did not impact dwell time in this study, suggesting that the

biases across longer periods of threat exposure may not be as prominent in anxious versus non-anxious youth (Shechner et al., 2013).

Those with social anxiety disorder have also been shown to display hypervigilance towards emotional faces, irrespective of emotion (Wieser et al., 2009). In a free exploration eye-tracking study, Wieser et al. (2009) found that when socially anxious females view images of human faces depicting different emotions (happy, neutral, and angry), they show a higher probability of fixating first on emotional faces (Wieser et al., 2009).

Stimulus Duration

Interestingly, a recent meta-analysis has concluded that in contrast with vigilance biases towards threats found in adults, youth may not display such response behaviours (Lisk et al., 2020). Instead, anxious youth, while displaying initial vigilance towards threat, may display avoidant patterns of attention when viewing threats across later stages of attention (Lisk et al., 2020). For example, those with social phobia typically avoid social situations, such as parties, that in turn limit social interactions and hinder social development (Roy et al., 2015). This may be seen as a repressive coping style, also known as the "vigilance-avoidance hypothesis" (Derakshan et al., 2007). The vigilance-avoidance hypothesis suggests that when anxious individuals are initially exposed to threats (i.e., the vigilance stage), they orient more quickly to the threatening stimuli but then later avoid the threatening stimuli (i.e., the avoidant stage) (Derakshan et al., 2007; Mogg & Bradley, 1998; Rosen et al., 2019). As a result, stimulus duration may be an important variable in understanding the cognitive mechanisms behind attentional biases in those with anxiety disorders as if only short durations are used, it may be difficult to observe the delayed avoidance patterns that have previously been shown.

1.5. Associations Between Anxiety, Attention Biases, and Social Skills

As mentioned previously, adolescence is a key phase for the development of anxiety. Previous research has also shown that both adults and youth with anxiety have impairments in social competence and support (de Lijster et al., 2018; Schneider, 2009). Social competence can be defined as the effectiveness individuals have in social interactions, such as possessing the ability to maintain conversations and navigate conflict (Coroiu et al., 2015). Unfortunately, feelings of anxiety often lead to individuals lacking social competence, potentially due to negative attentional biases (Clark & Wells, 1995; Coroiu et al., 2015; Hofmann, 2007; Nozadi et al., 2018). More specifically, those with increased anxiety typically view social interactions negatively, with a greater focus on past failures and a belief that others evaluate them poorly in comparison to their healthy peers, ultimately leading to ineffective coping mechanisms (Clark & Wells, 1995; Hofmann, 2007; Nozadi et al., 2018), and potentially poorer social skills. Importantly, social competence can be improved through social skills training and interventions, especially in the youth population (January et al., 2011). Thus, developing new interventions, such as training to alter one's attention bias, may help lower anxiety symptoms, ultimately leading to more successful social interactions.

1.6. Limitations of Recent Research

1.6.1. Use of Static Stimuli

Despite the exciting use of eye-tracking technology to conduct attention research, a current limitation of this research is the use of static images for stimuli. While the use of static images may be useful for investigating attentional processes under controlled laboratory conditions, static images cannot adequately depict real-life social interactions, ultimately limiting the generalizability of findings outside the lab (Fu & Pérez-Edgar, 2019; Lidle & Schmitz, 2022).

Previous research has found that gaze patterns differ when comparing computer-based studies to real-world social interactions (Laidlaw et al., 2011; Lidle & Schmitz, 2022). Blais et al. (2017) also found that fewer fixations may occur to main facial features when viewing dynamic stimuli in comparison to static images. Further, a recent study conducted by Weeks et al. (2019) investigated gaze avoidance with a dynamic social simulation task using eye-tracking equipment. When viewing videos with an actor providing positive and negative feedback, those with social anxiety disorder displayed gaze avoidance of both the positive and negative social feedback videos compared to demographically-matched healthy controls (Weeks et al., 2019). Overall, visual attention processes may differ between static and dynamic stimuli and it is crucial to use dynamic stimuli when measuring ocular movements and patterns using eye-tracking technology for optimal ecological validity (Blais et al., 2017).

Few studies have investigated attentional biases in youth with anxiety when they are viewing social interactions involving multiple people. One related study focused on the impact of loneliness on visual attention patterns when viewing social interactions (Bangee et al., 2014). When viewing positive and negative social interaction video footage, lonely young adults were more likely than their healthy peers to fixate first on threatening stimuli; thus, lonely young adults may display initial attentional vigilance towards threatening stimuli (Bangee et al., 2014). Despite this study focusing on loneliness rather than anxiety, previous research has shown a bidirectional relationship exists between loneliness and anxiety - loneliness could be manifested in anxiety and vice versa (McDonald et al., 2022; Qualter et al., 2013). Taking this into consideration, it is imperative to investigate the potential biases associated with anxiety when viewing dynamic videos of social interactions to gain more insight into the cognitive mechanisms behind visual attention processes in anxious emerging adults.

1.7. Current Study

Previous research has demonstrated the importance of negative attentional biases in the development and maintenance of anxiety disorders in youth (Dudeney et al., 2015); however, few studies have used modern eye-tracking software to explore attentional biases in emerging adults using dynamic, social stimuli, which are more depictive of real-life scenarios (Hessels, 2020; Lidle & Schmitz, 2022; Schmidtendorf et al., 2018). Further, while the current literature to date has demonstrated the association between anxiety and poor social competence (Miers et al., 2013), we are not aware of any study that has investigated the impact of anxiety severity and negative attention biases on social competence, measured using modern eye-tracking software. As such, the current study will break new grounds as we aim to answer the following question: Do emerging adults with anxiety show an attention bias towards negative stimuli, and if so, is this bias related to poorer social skills and does it help explain the link of anxiety to poor social competence?

In the study presented in this thesis, our overarching hypotheses are that 1) increased anxiety symptoms will be associated with attentional shifts towards threatening, dynamic stimuli and 2) the relationship between anxiety and social competence will be mediated by negative attentional biases. This research will provide important information regarding the cognitive mechanisms behind anxiety and social competence in emerging adults, ultimately leading to possible new therapeutic techniques such as training to alter one's negative attentional bias, to help those emerging adults who suffer from anxiety in terms of their social competence.

CHAPTER 2. ATTENTIONAL BIASES FOR DYNAMIC STIMULI AND ASSOCIATIONS WITH SOCIAL SKILLS IN EMERGING ADULTS WITH ANXIETY

Contribution Statement

The manuscript included in this thesis was written by Hailey Burns, under the co-supervision of Drs. Sandra Meier and Raymond Klein. Hailey Burns also collected the data and completed the data analyses. Nicholas Murray also collected a portion of the data from participants. Pristine Garay assisted in participant recruitment and communication. Austin Hurst assisted in developing the scripts/programs for the eye-trackers that enabled the team to perform the research project. The manuscript was also revised by Hailey Burns following advice of her thesis committee: Dr. Sandra Meier, Dr. Raymond Klein, Dr. Sherry Stewart, and Dr. Jose Mejia.

2.1. Introduction

Anxiety disorders, which can be characterized by excessive worry and fear that lead to severe distress and debilitation, are among the most common psychological disorders in society today (Remes et al., 2016; Terlizzi & Villarroel, 2020; World Health Organization, 2022a). Several risk factors have been associated with anxiety disorders, including genetics, chronic disease, trauma, adverse family environment, behavioural inhibition, age, and female sex (Blanco et al., 2014; Cabral & Patel, 2020; Q. Wang et al., 2014). For emerging adults in particular, anxiety is one of the leading causes of disability, with an estimated prevalence of 3.6 - 4.6% worldwide (World Health Organization, 2021). Importantly, anxiety disorders often start in childhood and may lead to various comorbidities, such as depression and substance use disorders, as well as a cascade of emotional, social, and functional impairments later in life (Copeland et al., 2014; Kessler, Berglund, et al., 2005; Lisk et al., 2020; Smith & Book, 2008; ter Meulen et al., 2021). Unfortunately, despite the importance of preventing and treating anxiety in childhood, adult anxiety disorders have been more thoroughly researched (Dudeney et al., 2015). Thus, it is critical to investigate early risk factors and/or markers that may lead to or support the development of new interventions (Lisk et al., 2020).

Whereas there is evidence of significant undertreatment of anxiety disorders, current treatments and interventions include pharmaceutical medications, psychotherapy, or a combination of both (Bandelow et al., 2017; Bystritsky et al., 2013). Despite previous literature indicating these various treatments are effective in lowering anxiety severity, many medications have limitations, such as adverse side effects, drug dependence, and treatment resistance (Bystritsky et al., 2013; Hofmann et al., 2012; Mogg & Bradley, 2016; Ravindran & da Silva, 2013). Problems also arise with psychotherapy, such as financial barriers and lack of access to

treatment (Arch & Craske, 2009; Bandelow, 2020; Hakamata et al., 2010). As a result, the need to investigate new accessible interventions to help prevent anxiety, as well as treat those who may be resistant to conventional treatments, is crucial (Bystritsky et al., 2013).

Cognitive theories of anxiety disorders suggest that abnormalities in experiencing social situations and information processing, such as biases in attentional processes, are key factors in the development of anxiety (Boettcher et al., 2013; Eysenck et al., 2007; Macatee et al., 2017; Rapee & Heimberg, 1997). In particular, an attention bias is characterized as selective allocation towards emotional stimuli over neutral stimuli (Cisler & Koster, 2010; Kuckertz & Amir, 2015; Macatee et al., 2017). A maladaptive attention bias towards negative or threatening external cues, such as an angry face on an acquaintance, may potentially lead to heightened arousal, social fears, and negative evaluations of social situations (Burris et al., 2019; Lau & Waters, 2017; Lisk et al., 2020; Morales et al., 2016; Pérez-Edgar et al., 2010, 2014; Roy et al., 2008).

Recent meta-analyses have shown that anxious children, emerging adults, and adults typically display a significantly greater attention bias towards negative, threat-related stimuli compared to the healthy population (Bar-Haim et al., 2007; Clauss et al., 2022; Dudeney et al., 2015); however, some research has shown that younger individuals are more avoidant of threat-related stimuli (Lisk et al., 2020). Thus, distinctions between attentional biases may be dependent upon age (Dudeney et al., 2015). Moreover, there may be a switch between an initial orientation bias for threat-related stimuli (Armstrong & Olatunji, 2012) followed by attentional avoidance during later dwell times (Clauss et al., 2022; Lisk et al., 2020). More specifically, anxious youth may initially become hyperaware of threatening stimuli, resulting in quicker fixations to negative stimuli at early stages of threat processing, but then they may avoid the threat at later stages, also known as the “vigilance-avoidance” hypothesis (Bar-Haim et al., 2007; Beck & Clark, 1997;

Eysenck et al., 2007; Lisk et al., 2020; Mogg et al., 2004; Singh et al., 2015). In contrast, the attention-maintenance model suggests that, while anxious individuals may not display a reflexive orientation towards negative, threat-related stimuli, once the threat has been detected, they may have difficulty disengaging away from the threat (i.e., maintenance) (Clauss et al., 2022). Importantly, emerging adults with anxiety displaying maintenance negative attentional biases or vigilance-avoidance behaviours may have ineffective coping strategies to regulate distress, leading to poorer social competence (Nozadi et al., 2018).

Despite recent evidence demonstrating that emerging adults with increased anxiety symptoms may develop threat-related attention biases and poorer social competence, current research surrounding anxiety disorders and social attention focuses primarily on the use of static images of human emotional expressions when using eye-tracking software (Hessels, 2020; Lidle & Schmitz, 2022; Schmidtendorf et al., 2018). While these methods have aided in the ongoing research surrounding attentional biases, static photos are not depictive of real-life social interactions and differences in visual attention patterns have been found when comparing static-based stimuli to real-life scenarios (Laidlaw et al., 2011; Lidle & Schmitz, 2022). To our current knowledge, no studies to date have used modern eye-tracking technology to investigate potential attentional biases in dynamic videos depicting social interactions in relation to anxiety and interpersonal competence.

Taking these limitations into consideration, the current research study aims to determine whether emerging adults with heightened anxiety symptoms display an attentional bias towards negative, dynamic stimuli and if attentional biases mediate the relationship between anxiety and interpersonal competence. We hypothesize that (1) emerging adults with higher anxiety symptoms will fixate more quickly on negative, dynamic stimuli, (2) higher anxiety symptoms

will be associated with increases in dwell time on negative, dynamic social stimuli, and (3) the relationship between anxiety symptoms and interpersonal competence will be mediated by negative attentional biases. Not only will this research help standardize and validate the use of social videos in anxiety research and eye-tracking, but it may ultimately contribute to advancements in therapeutic interventions, such as attentional bias modification training techniques using modern smartphone applications, that may ultimately help anxious emerging adults conquer their anxiety and improve their social competence.

2.2. Methods

2.2.1. Participants

Sixty-nine emerging adults were initially recruited between October 2022-April 2023. Inclusion criteria for this study were as follows: 1) biologically female or identify as female, 2) between the ages of 18-24, 3) do not have a severe visual impairment that may influence eye-tracking results, 4) currently not in inpatient care (as these individuals have restricted phone access), and 5) own a smartphone with either an iOS or Android operating systems for our mobile sensing app. The last two criteria were related to another, ongoing study and are not relevant to the current study. Since anxiety symptoms, specifically social anxiety, are more common in females than males, we intentionally restricted our sample to females (Steel et al., 2014). We restricted our age to individuals between the ages of 18-24 as attentional biases have also been found to be age-specific (Tomaszczyk & Fernandes, 2014) and the end of emerging adulthood is suggested to be around the age of 25 (Arnett, 2000). Following withdrawals, our final sample was 62 participants with an average age of 20.44 years (SD = 1.84).

2.2.2. Procedure and Consent

Potential participants were recruited through various online advertisements, including Instagram, as well as study posters and Dalhousie University's experimental recruitment website (SONA). To target those who may be more anxious and who may benefit more from our research, the social media advertisements included wording such as "Are you a shy or socially anxious female?" (Appendix B). Interested participants were sent screening questions through the Research Electronic Data Capture (REDCap) data platform, a widely used online platform for secure data collection (Harris et al., 2009, 2019; Patridge & Bardyn, 2018). Participants that met the inclusion criteria were then asked to complete the consent procedure. After reading the consent form, participants were asked to answer questions to ensure they understood the study and were allowed to ask questions through email to the researchers before electronically signing the consent form.

Consented participants were then asked to complete self-reported questionnaires regarding demographic information, their perceived social skills, as well as their anxiety symptoms on REDCap. Participants were then scheduled for an in-person visit at the Izaak Walton Killam Hospital (IWK) where eye-tracking software was employed to assess attentional biases by watching dynamic videos depicting social situations (see Figure 1 for a schematic of the study procedure).

Figure 1

Schematic of experimental design

The study was approved by the IWK Research Ethics Board (File no. 1027338) in accordance with the Tri-Council Policy Guidelines. Participants were awarded either three credits towards one of their undergraduate classes or a $50 CAD gift card for their time and effort.

2.2.3. Assessments

The Screen for Child Anxiety Related Emotional Disorders (SCARED)

The Screen for Child Anxiety Related Emotional Disorders (SCARED) questionnaire was used to assess anxiety symptoms in participants, aged 18. The adult version (SCAARED) was used for the remaining participants, aged 19-24 (Angulo et al., 2017; Birmaher et al., 1997; Runyon et al., 2018). The SCARED questionnaire consists of 41 items while the adult version contains 44 items. Both use a 3-point Likert Scale, ranging from 0 (“not true or hardly ever true”) to 2 (“very true or often true”) (Birmaher et al., 1997; Runyon et al., 2018). The SCARED and SCAARED questionnaires measure five anxiety subscales: generalized anxiety disorder, social anxiety disorder, separation anxiety disorder, panic disorder or significant somatic symptoms, and school phobia (Arab et al., 2016; Birmaher et al., 1999). Further, SCARED has been shown to have high internal consistency for both the total score ($\alpha = 0.91$ - 0.92) and

subscales (α = 0.72 - 0.83) and moderate to large test-retest reliabilities for both total score (r = 0.78; 95% confidence interval = 0.89 - 0.91) and individual subscales (r = 0.45 – 0.711; 95% confidence interval = 0.53 – 0.87) (Hale et al., 2011; Runyon et al., 2018). The adult version has also been shown to have excellent internal consistency for the total score (α = 0.97), as well as for the subscales (α = 0.84 - 0.86) (Angulo et al., 2017). Only the total score was used for this study. Both questionnaires are self-reported, with higher scores indicating greater symptom severity (Angulo et al., 2017; Birmaher et al., 1997). Due to the differing number of items, the SCARED scores were divided by 41 (the number of items) and then multiplied by 44 (the number of SCAARED items) to put the scores into a common metric. The SCARED of the current study had a satisfactory internal consistency for the total score (α = 0.94; 95% confidence intervals = 0.86 - 0.99). The internal consistency for the total score for the SCAARED in the current sample was satisfactory as well (α = 0.93; 95% confidence intervals = 0.90 – 0.95).

Interpersonal Competence Questionnaire (ICQ-15)

To assess interpersonal competence, a shortened version of the Interpersonal Competence Questionnaire (ICQ-15) was used (Coroiu et al., 2015). The ICQ-15 was derived from the ICQ-30 through a step-wise decision process (Coroiu et al., 2015). To decrease time commitment, as well as feelings of boredom and fatigue that are typically associated with long questionnaires, the ICQ-15 was specifically chosen over the original ICQ (Gogol et al., 2014; Robins et al., 2001; Sahlqvist et al., 2011). The scale measures five 3-item subscales of social competence: 1) conflict management, 2) initiating relationships, 3) negative assertion, 4) self-disclosure of personal information, and 5) providing emotional support (Buhrmester et al., 1988; Coroiu et al., 2015; Kanning, 2006). The ICQ-15 has been shown to have satisfactory internal consistency reliability for the total score (α = 0.87), as well as the subscales (α = 0.61 – 0.75) (Coroiu et al.,

2015). Importantly, a scale is considered reliable when the Cronbach's alpha is greater than 0.6 (Coroiu et al., 2015; Raharjanti et al., 2022), in the case of shorter scales. The ICQ-15 includes 15 items on a 4-point Likert scale ranging from 1 ("I'm poor at this; I'd feel so uncomfortable and unable to handle this situation, I'd avoid it if possible") to 4 ("I'm EXTREMELY good at this; I'd feel very comfortable and could handle this situation very well") (Buhrmester et al., 1988; Kanning, 2006). For the current study, only the total score was used for analysis and had a satisfactory internal consistency ($\alpha = 0.71$; 95% confidence intervals = 0.60 – 0.81).

2.2.4 Eye-Tracking

Video Stimuli

Stimuli were 30-second video clips from movies and television shows. Four videos per emotion type were used, which included positive (e.g., "The Office" clip of two individuals getting married), negative (e.g., "Stranger Things" clip of a young female being bullied), and neutral (e.g., "The Breakfast Club" clip of students eating lunch in a library) content, for a total of 12 videos (see Table 1 for all media used in the study). As we wanted each video to be relatable to our participants, we had three emerging adults take part in a Youth Advisory where they provided their opinions and comments regarding the video stimuli, and we adapted accordingly. Each video was also chosen to have a similar colour scheme as colour may influence subjective feelings towards a visual scene and certain colours may involuntarily attract visual attention (Bekhtereva & Müller, 2017; Suk & Irtel, 2010).

The set-up consisted of a 24-inch Dell (64-bit operating system) computer screen with a resolution of 1920 x 1080. The experimental procedure was constructed using Python (version 3.9.13) and all stimuli were presented on a grey background. For each trial, participants viewed two vertically aligned videos without audio for 30 seconds on a split screen. In total, participants

completed 6 trials, which included two pairings of each combination (i.e., positive + neutral, positive + negative, and negative + neutral pairings). The order of the pairings was randomized, as were the pairing content and the side specific videos appeared on. More specifically, the computer randomly chose among the categories (e.g., positive, negative, and neutral) to make new pairings for each participant. As each pairing was shown twice, one trial would have a certain emotional content shown on one side of the screen, and when the computer showed the same trial combination a second time, the opposite would occur. For example, the first trial that showed positive + negative may have the positive video appear on the right side of the screen. For the second positive + negative trial, the positive video would appear on the left side of the screen. The entire experiment lasted an estimated 3 - 4 minutes.

Table 1

List of videos shown to participants

Positive Videos	Negative Videos	Neutral Videos
Grey's Anatomy Clip of individuals dancing	*Glee* clip of male individuals fighting outside	*The Big Bang* clip of individuals sitting in a cafeteria eating
Alexa and Katie clip of two females happy to see each other, hugging	*Stranger Things* clip of a young female being bullied	*The Fosters* clip of an individual playing the piano to an audience
The Office clip of two individuals getting married	*Glee* clip of female individuals fighting in a school hallway	*The Breakfast Club* clip of students eating lunch in a library
The Vampire Diaries clip of multiple individuals hugging	*13 Reasons Why* clip of two females arguing in a coffee shop	*Gilmore Girls* clip of students sitting in a classroom listening to a lecture

Note. All videos were 30-seconds in length.

2.2.5. Procedure and Apparatus

Before the experiment began, participants were asked if they had consumed any substances that day, such as marijuana, caffeine, and/or nicotine, that might affect their attention – this information was recorded for potential confounding variables. Participants were then placed in front of the Display PC and eye-tracking equipment in the laboratory at the IWK. The Eye-Link 1000 Plus eye-tracker with remote tracking at a sampling rate of 500Hz (SR Research, US) was used to track the participant's gaze throughout the study procedure. In accordance with the Eye-Link 1000 Plus manual, a 25mm lens was used as it provides better recording data quality when performing monocular remote tracking (SR Research, 2017). A target sticker was placed on the participant's forehead, between the two eyes, to track the head position of each participant. While the right eye was chosen to be tracked for most participants, the left eye was tracked if the illuminator was obstructed (for example, by glasses or the participant's nose). Participants were adjusted to sit around 600 mm away from the camera to achieve optimal accuracy and precision (SR Research, 2017).

In a different room, separated by a two-way mirror, researchers adjusted the pupil and cornea reflection thresholds of each participant for continuous detection on the Host PC. Then the eye-tracker was calibrated using a standard grid followed by a validation procedure (SR Research, 2017). The calibration procedure was repeated if the validation was poor. In brief, participants were instructed to stare and focus on the center of each new fixation dot that was being shown on the screen.

Before the trial began, participants were asked to look wherever they wished. Each video trial began with a prompt on the Display PC asking participants to "Press any key to continue." Following, a fixation dot was displayed in the center of the screen. Once the participant was

focusing properly on the fixation dot, the researchers manually accepted the fixation on the Host PC and the stimuli were shown. This was repeated before each trial. Please see Figure 2 for an example of a trial.

Figure 2

Example of a typical positive-negative trial pairing

Note. The red boxes indicate areas of interest.

2.2.6. Covariates

Demographic information, including age, ethnicity, and education of the participants' mothers were collected and used as covariates in the study. The location of the video on the computer screen (i.e., if the video appeared on the left or right side of the screen), as well as the trial number were also included in the data analyses as covariates. The education of a participant's mother was used as a covariate to estimate socioeconomic status as participants may

not be aware of their parent's income (Lien, 2001). Further, maternal education has previously been shown to be a core dimension of socioeconomic status, which is a significant social determinant that may impact mental health outcomes (Alegría et al., 2018; Jackson et al., 2017; Wong & Edwards, 2013). Since previous research has demonstrated that individuals may have a slight bias towards the right or left side of their visual field, the location of the video on the screen was included as a covariate (Gray et al., 2021; Löwenberg et al., 2020). Lastly, the trial number was included as a covariate to account for potential visual fatigue effects from the experiment (Valliappan et al., 2020).

2.2.7. Data Analysis

All statistical analyses were completed using R programming language (version 4.2.2) and RStudio (version 2022.07.02 Build 576). Of the initial 69 participants, 4 participants withdrew after completing the consent form and 3 participants withdrew following or during the questionnaire portion of the study. These participants were excluded from further analyses. The final sample did not differ in anxiety or interpersonal competence scores, age, socioeconomic status, or ethnicity in comparison to the two who withdrew following the questionnaire portion ($p > 0.05$). Three additional participants had a missing value for the SCARED or SCAARED questionnaires as they chose the "Prefer not to answer" option. Due to the low number of missing values, the sample mean was imputed for the questions the participants chose not to answer before scoring the questionnaire.

Following data filtration, descriptive statistics were calculated for the sample, including demographic information. To assess the first two hypotheses, we ran separate linear mixed-effects models with time to first fixation, dwell time, and the number of fixations as the respective outcomes of interest and the type of video (i.e., positive, negative, or neutral), the

pairings shown (i.e., positive-negative, positive-neutral, and negative-neutral), and anxiety symptoms as the predictors. Predictors were entered into the models in three steps: (a) type of video, pairings, and anxiety symptoms; (b) the two-way interactions; and (c) the three-way interaction. Location of the video, age, trial number, socioeconomic status, and ethnicity were included as covariates in the three models. To probe any significant three-way interactions, we ran linear mixed-effect models stratified by pairings with type of video and anxiety symptoms as the predictors. We hypothesized that participants with higher anxiety symptoms would fixate more quickly on negative videos than those with fewer anxiety symptoms. We also hypothesized that higher anxiety symptoms would be associated with an increase in dwell time on negative content. The analysis investigating the number of fixations was exploratory. We did not adjust for multiple testing as this is a novel study. Lastly, a mediation analysis was conducted to test our third hypothesis. The main effects of anxiety on dwell time and social competence, as well as dwell time on social competence, were tested using separate linear mixed effects models (i.e., for anxiety and dwell time, as well as social competence and dwell time) and a regression model (i.e., for anxiety and interpersonal competence as there were no repeated measures).

2.3. Results

2.3.1. Sample Characteristics

The final sample included 62 participants, M age = 20.44 (SD = 1.84), who were all biologically female. All participants identified as women other than one, who preferred not to disclose their gender identity (Table 2). The data were screened for outliers above or below three standard deviations. As less than five participants consumed marijuana and/or nicotine before the eye-tracking portion of the study, and only 27 consumed a form of caffeine (i.e., latte, tea, coffee, etc.), we did not adjust for these substances. Participants had an average anxiety score of 42.23

(SD = 15.86). Importantly, scores greater than 23 on the SCAARED and 25 on the SCARED may indicate the presence of an anxiety disorder. The SCAARED has been found to have normal scores of 14.7 (SD = 13.8) for individuals without anxiety disorders and 39.6 (SD = 21.5) for those with any anxiety disorder (Angulo et al., 2017). For the SCARED, children with anxiety have previously been found to have an average score of 26.76 (SD = 14.68) while non-anxious children reported an average of 17.24 (SD = 12.06) (Birmaher et al., 1997). Fifty-two participants of our final sample reported scores greater than the clinical cut-off point. Further, participants reported an average interpersonal competence score of 41.65 (SD = 5.70). A previous study found a norm of 39.97 (SD = 7.01) for the ICQ-15 (Radetzki et al., 2022).

On average, participants took 1.61 (SD = 1.21) seconds per trial to first fixate on negative videos, 1.60 (SD = 1.05) seconds to first gaze at positive videos, and 2.00 (SD = 1.42) seconds to first orient their attention towards neutral videos, regardless of the video pairing or anxiety score. Further, participants spent 16.02 seconds (SD = 4.79) per trial gazing at negative videos, 16.27 seconds (SD = 4.93) at positive videos, and 11.71 seconds (SD = 4.35) at neutral videos, regardless of the video pairing and anxiety level. Lastly, participants fixated on negative videos an average of 12.28 (SD = 4.75) times per trial, on positive videos an average of 13.89 (SD = 4.50) times, and on neutral videos an average of 9.60 (SD = 4.18) times.

Table 2

Demographic Information

Parameters	N	Mean	SD
Sex		100% Female	
Gender		98% Women	
Age		20.44	1.84
Ethnicity			
Caucasian	42		
Asian	10		
Black or African American	6		
Hispanic/Latine	2		
Indigenous	3		
Other	7		
Mental Disorder Diagnosed by Professional		61% No	
Education Mother			
Did not finish high school	2		
Finished high school	7		
Further education/ University	16		
Finished University	37		
I don't know	0		
Prefer not to answer	0		
Anxiety		42.23	15.86
Interpersonal Competence		41.65	5.70
Time to First Fixation			
Negative Video		1.61	1.21
Positive Video		1.60	1.05
Neutral Video		2.00	1.42
Dwell Time			
Negative		16.02	4.79
Positive		16.27	4.93
Neutral		11.71	4.35
Number of Fixations			
Negative		12.28	4.75
Positive		13.89	4.50
Neutral		9.60	4.18

Note. N = number of participants; SD = standard deviation.

2.3.2. Linear Mixed-Effects Analysis: Anxiety

Time to First Fixation

To investigate if those with increased anxiety symptoms display a vigilance attention bias, we first conducted a linear mixed-effects model with time to first fixation as our outcome variable. There were significant main effects of anxiety (b = -0.01, $t(57) = -2.35$, $p = 0.02$) and the type of video (i.e., positive, negative, and neutral clips) (b = 0.23, $t(674) = 3.99$, $p < 0.001$) on time to first fixation. Those with higher anxiety fixated more quickly on the videos regardless of video type. And regardless of anxiety level, participants fixated more quickly towards the emotional videos (i.e., positive and negative clips) over the neutral videos. The type of pairings (b = 0.09, $t(674) = 1.60$, $p = 0.11$) did not have a significant effect on time to first fixation. The two-way and three-way interactions between anxiety, type of video, and pairings were nonsignificant and did not improve the model; thus, they were removed. Interestingly, the location of the video (b = 0.43, $t(674) = -4.83$, $p < 0.001$) was also significant, highlighting that participants fixated quicker towards videos on the left side of the screen over the right side (Table 3).

Table 3

Time to First Fixation Linear Mixed Effects Model Output

Predictor	Value (b)	SE	df	t-value	p-value
Anxiety	**-0.01***	0.003	57	-2.35	**0.02**
Pairings	0.09	0.06	674	1.60	0.11
Type of Video	**0.23****	0.06	674	3.99	**< 0.001**
Video Location	**0.43****	0.09	674	4.83	**< 0.001**
Age	-0.02	0.03	57	-0.86	0.39
Trial Number	-0.04	0.03	674	-1.40	0.16
SES	0.04	0.03	57	-1.63	0.11
Ethnicity	0.03	0.10	57	0.30	0.77

Note. Dependent variable is time to first fixation. SE = Standard Error; df = Degrees of Freedom, b = unstandardized coefficient; SES = socioeconomic status. *$p < 0.05$; ** = $p < 0.01$.

Dwell Time

To further explore the potential biases regarding attention maintenance, we performed a linear effects model with dwell time as our outcome variable. There were significant main effects of pairings (b = 4.21, $t(674) = 2.07$, $p = 0.04$) and type of video (b = -1.79, $t(674) = -2.60$, $p = 0.01$) on dwell time. The main effect of anxiety score on dwell time was not significant (b = 0.04, $t(57) = 1.03$, $p = 0.31$). The two-way interactions of anxiety scores and pairings (b = -0.10, $t(674) = -2.21$, $p = 0.03$) and between pairings and type of video (b = -2.00, $t(674) = -2.41$, $p = 0.02$) were also found to be significant. In general, there were significant differences found in the negative-neutral and positive-neutral pairings, with participants spending more time gazing at the positive and negative videos over the neutral clips. The two-way interactions were qualified by the significant three-way interaction. More specifically, our results demonstrate the three-way interaction between anxiety score, pairings, and type of video was significant for dwell time (b = 0.04, $t(674) = 2.28$, $p = 0.02$). All covariates were non-significant (Table 4).

Table 4

Dwell Time Linear Mixed-Effects Model Output

Predictor	Value (b)	SE	df	t-value	p-value
Anxiety	0.04	0.03	57	1.03	0.31
Pairings	**4.21***	2.04	674	2.07	**0.04**
Video Type	**-1.79***	0.69	674	-2.60	**0.01**
Video Location	0.31	0.35	674	0.88	0.38
Age	0.02	0.10	57	0.16	0.87
Trial Number	0.06	0.10	674	0.59	0.56
SES	-0.04	0.10	57	-0.37	0.71
Ethnicity	0.09	0.38	57	0.23	0.82
Anxiety x Pairings	**-0.10***	0.05	674	-2.21	**0.03**
Anxiety x Video Type	-0.01	0.02	674	-0.86	0.39
Pairings x Video Type	**-2.00***	0.83	674	-2.41	**0.02**
Anxiety x Pairings x Video Type	**0.04***	0.02	674	2.28	**0.02**

Note. Dependent variable is dwell time. SE = Standard Error; df = Degrees of Freedom, b = unstandardized coefficient; SES = socioeconomic status. * $p < 0.05$.

To probe the significant three-way interaction, we completed independent linear effects models stratified by pairings. For the negative-neutral pairings, a significant main effect of anxiety scores (b = 0.20, $t(57) = 2.33$, $p = 0.02$) on dwell time, with greater anxiety levels associated with greater dwell time overall, was found. The type of video was not significant (b = -2.22, $t(182) = -1.48$, $p = 0.14$). There was a significant interaction between anxiety and type of video (b = -0.08, $t(182) = -2.33$, $p = 0.02$), suggesting that as anxiety symptoms increase, dwell time on negative videos increases, while dwell time on neutral videos decreases. Location was also significant (b = -1.46, $t(182) = -2.76$, $p = 0.01$), suggesting that participants spent less time dwelling on the right side of the screen (see Table 5 and Figure 3).

Table 5

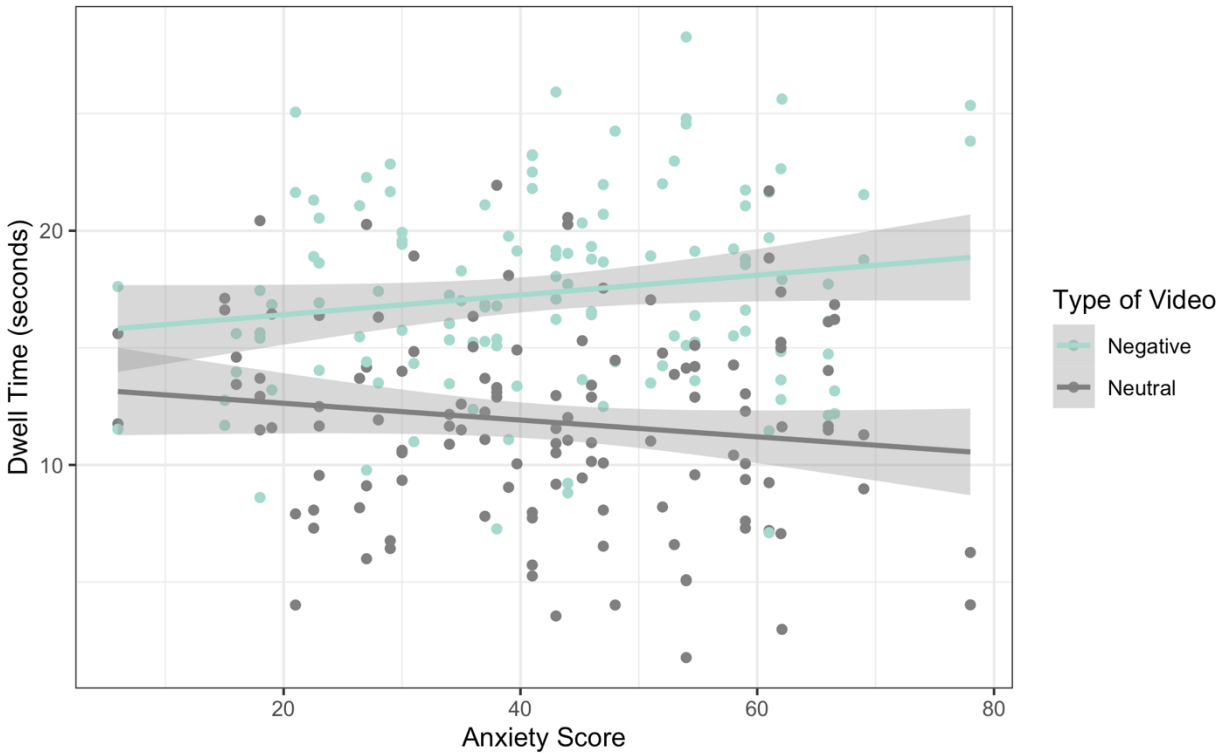
Dwell Time Linear Mixed Effects Model Output for Negative-Neutral Pairings

Predictor	Value (b)	SE	df	t-value	p-value
Anxiety	**0.20***	0.09	57	2.33	**0.02**
Video Type	-2.22	1.51	182	-1.48	0.14
Video Location	**-1.46****	0.53	182	-2.76	**0.01**
Age	0.03	0.16	57	0.19	0.85
Trial Number	-0.002	0.16	182	-0.01	0.99
SES	-0.06	0.15	57	-0.38	0.70
Ethnicity	0.07	0.57	57	0.12	0.91
Anxiety: Video Type	**-0.08***	0.03	182	-2.33	**0.02**

Note. Dependent variable is dwell time. SE = Standard Error; df = Degrees of Freedom, b = unstandardized coefficient; SES = socioeconomic status. * $p < 0.05$; ** = $p < 0.01$.

Figure 3

The interaction between anxiety scores and video type for dwell time in negative-neutral pairings



For the positive-neutral pairings, there was a significant main effect of the type of video on dwell time (b = -4.26, $t(182) = -5.21$, $p < 0.001$), highlighting that participants spent more time gazing at positive videos over neutral ones. Anxiety scores (b = -0.05, $t(57) = -1.28$, $p = 0.21$) and the interaction between anxiety and type of video (b = 0.03, $t(182) = 1.46$, $p = 0.15$) were not significant. All covariates were also non-significant (see Table 6 and Figure 4).

Table 6

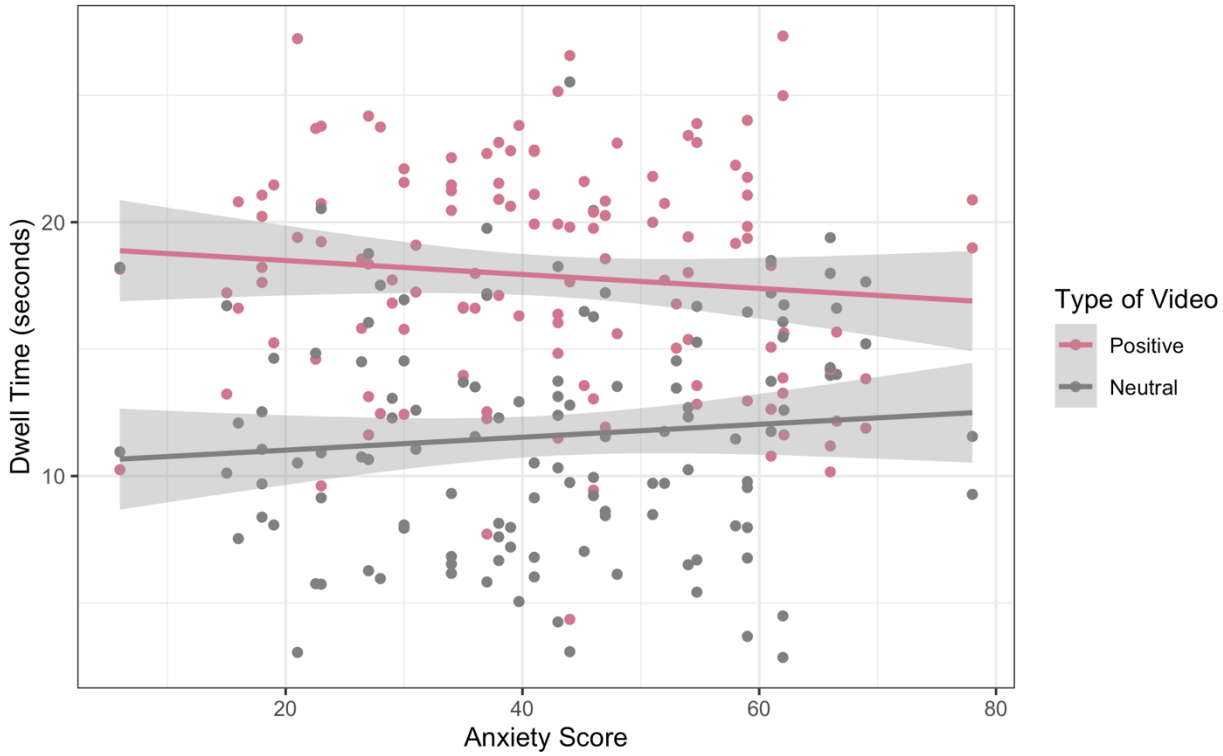
Dwell Time Linear Mixed Effects Model Output for Positive-Neutral Pairings

Predictor	Value (b)	SE	df	t-value	p-value
Anxiety	-0.05	0.04	57	-1.28	0.21
Video Type	**-4.26****	0.82	182	-5.21	**< 0.001**
Video Location	0.01	0.58	182	0.01	0.99
Age	0.03	0.17	57	0.19	0.85
Trial Number	-0.04	0.17	182	-0.22	0.82
SES	-0.04	0.16	57	-0.27	0.79
Ethnicity	0.07	0.62	57	0.11	0.91
Anxiety x Video Type	0.03	0.02	182	1.46	0.15

Note. Dependent variable is dwell time. SE = Standard Error; df = Degrees of Freedom, b = unstandardized coefficient; SES = socioeconomic status. ** $p < 0.01$.

Figure 4

The effect of video type (positive vs. neutral) and anxiety score on dwell time in positive-neutral pairings



Lastly, for the positive-negative pairings, there were no significant main effects of anxiety (b = 0.03, $t(57) = 0.48$, $p = 0.63$), type of video (b = 0.85, $t(182) = 0.47$, $p = 0.64$), or any covariates on dwell time (see Table 7). The interaction between anxiety and type of video (b = -0.02, $t(182) = -0.49$, $p = 0.62$) was also not significant (see Figure 5).

Table 7

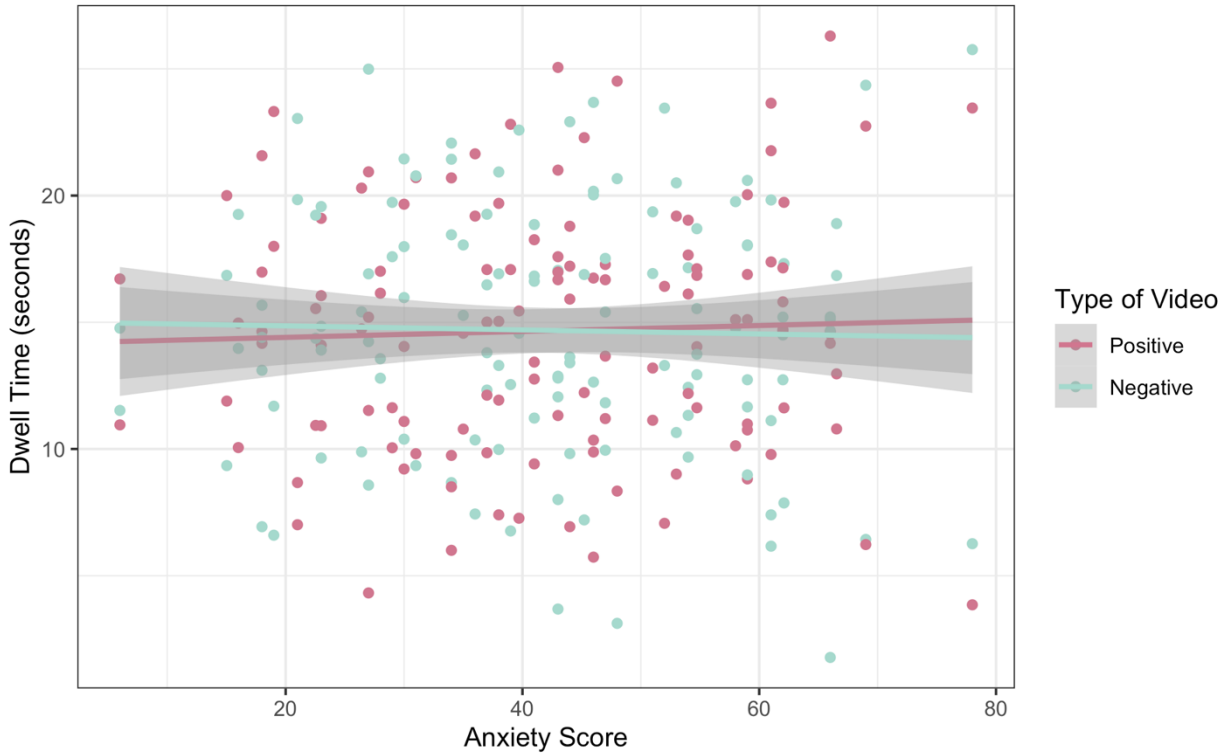
Dwell Time Linear Mixed Effects Model Output for Positive-Negative Pairings

Predictor	Value (b)	SE	df	t-value	p-value
Anxiety	0.03	0.06	57	0.48	0.63
Video Type	0.85	1.79	182	0.47	0.64
Video Location	0.53	0.63	182	0.84	0.40
Age	-0.01	0.19	57	-0.06	0.95
Trial Number	-0.01	0.19	182	-0.06	0.95
SES	-0.01	0.18	57	-0.06	0.95
Ethnicity	0.12	0.68	57	0.18	0.86
Anxiety x Video Type	-0.02	0.04	182	-0.49	0.62

Note. Dependent variable is dwell time. SE = Standard Error; df = Degrees of Freedom, b = unstandardized coefficient; SES = socioeconomic status.

Figure 5

The interaction between anxiety scores and video type for dwell time in positive-negative pairings



Number of Fixations

Lastly, we investigated the number of fixations participants made while looking at each video. There were significant main effects of the type of video (b = -1.65, $t(674) = -2.61$, $p = 0.01$) on the number of fixations, with participants having more fixations on the emotional content (i.e., positive and negative) over the neutral videos. The two-way interaction between pairings and the type of video was also significant (b = -1.58, $t(674) = -2.07$, $p = 0.04$), highlighting that participants had more fixations towards emotional content in positive-neutral (positive fixations = 15.09 (SD = 4.10), neutral fixations = 8.72 (SD = 3.64)) and negative-neutral pairings (negative fixations = 13.37 (SD = 4.68), neutral fixations = 10.48 (SD = 4.50)) while there were no differences in number of fixations toward each video type observed in positive-negative pairings (positive fixations = 12.69 (SD = 4.56), negative fixations = 11.19 (SD = 4.57)) (Table 8). The remaining variables were all non-significant.

Table 8

Number of Fixations Linear Mixed Effects Model Output

Predictor	Value (b)	SE	df	t-value	p-value
Anxiety	0.03	0.03	57	1.04	0.30
Pairings	3.47	1.87	674	1.85	0.06
Video Type	**-1.65***	0.64	674	-2.61	**0.01**
Video Location	0.40	0.32	674	1.23	0.22
Age	0.07	0.10	57	0.70	0.49
Trial Number	0.15	0.10	674	1.67	0.10
SES	-0.14	0.10	57	-1.43	0.16
Ethnicity	-0.25	0.37	57	-0.66	0.51
Anxiety x Pairings	-0.04	0.04	674	-1.10	0.28
Anxiety x Video Type	-0.01	0.01	674	-0.60	0.55
Pairings x Video Type	**-1.58***	0.76	674	-2.07	**0.04**
Anxiety x Pairings x Video Type	0.02	0.02	674	0.92	0.36

Note. Dependent variable is number of fixations. SE = Standard Error; df = Degrees of Freedom, b = unstandardized coefficient; SES = socioeconomic status. *$p < 0.05$.

2.3.3. Mediation Analysis: Interpersonal Competence

As only dwell time was found to have a significant three-way interaction, we first assessed the associations between the independent variable (anxiety score), mediator (dwell time), and dependent variable (competence). As seen previously in the linear mixed effects models above, anxiety is significantly associated with dwell time. For the linear regression model that tested the effect of anxiety on social competence, only anxiety (b = -0.14, $t(737) = -11.47$, $p < 0.001$), socioeconomic status (b = 0.58, $t(737) = 5.61$, $p < 0.001$), and ethnicity (b = 3.08, $t(737) = 7.81$, $p < 0.001$) were significant. Caucasian participants reported higher scores of social competence. Lastly, the linear mixed effects model that tested the effect of the mediator on

our outcome variable, not controlling for our predictor, only showed that the type of video (b = -3.60, $t(674) = -2.01$, $p = 0.04$) was significant, highlighting that participants dwelled more on emotional content over neutral content. Following the assumptions and requirements for mediations, the mediator must affect the dependent variable (Baron & Kenny, 1986). Thus, for the mediation analysis to proceed further in the current study, the three-way interaction between dwell time, pairings, and video type (b = <0.001, $t(674) = 0.01$, $p = 0.99$) needed to be significant with social competence. As the interactions were not significant, the mediation analysis did not proceed since the assumptions were not met as there was no association of the mediator with the outcome variable.

2.4. Discussion

This study investigated the relationship between anxiety and attentional biases in emerging adults using novel eye-tracking methods. We predicted that emerging adults with greater anxiety severity, in comparison to those with lower anxiety symptoms, would 1) fixate more quickly towards negative video stimuli, and 2) spend more time gazing at the negative, dynamic social stimuli. An exploratory analysis was also conducted regarding the number of fixations. We also theorized that the associations between anxiety and lower interpersonal competence would be mediated by negative attentional bias. Overall, our results suggest that young people fixate on emotional content (i.e., positive and negative videos) more quickly than on neutral content. We also found that emerging adults with anxiety fixate faster in general, independent of emotional content of the videos. We found that participants spent more time gazing at emotional content (i.e., positive and negative videos over neutral videos). Importantly, as anxiety symptoms increased, longer gaze durations toward negative than neutral videos when

viewing negative-neutral pairings were found. This effect was not seen when participants were shown positive-negative video pairings.

One of the core findings of this research study is that while emerging adults in general fixate more quickly on emotional than non-emotional content, those with greater anxiety severity display initial vigilance when viewing dynamic, social stimuli. Similarly, a study conducted by Nummenmaa et al. (2006) found that university students were more likely to fixate quicker on emotional pictures over a neutral picture. Further, our anxiety results are in line with previous findings, as many studies have found that those with anxiety exhibit attentional vigilance (Klumpp & Amir, 2009; LoBue & DeLoache, 2010; Roy et al., 2008; Waters et al., 2010). More specifically, anxious individuals may display initial hypervigilance towards stimuli in order to determine a perceived level of threat in their environment (Capriola-Hall et al., 2020). This is also known as the vigilance model, which proposes that anxious individuals may orient their attention more quickly in the environment, towards threat-related information, as these individuals have a lower threshold for threat detection (Bar-Haim et al., 2007; Beck & Clark, 1997; Rosen et al., 2019).

However, the vigilance model only partly explains the current findings, as we did not find a specific vigilance bias towards negative stimuli, but rather towards stimuli in general. This may be due to methodological differences, such as stimuli type, stimulus duration, too few examples of each stimulus type/pairing, and/or the current study being slightly underpowered in terms of sample size. More specifically, it is difficult to disentangle whether viewing two trials of each pairing is sufficient to determine vigilance behaviours towards negative stimuli. On the other hand, we purposely restricted our experiment to 6 total trials to limit potential fatigue effects for our participants. Further, previous research has mostly focused on static images of human faces,

with few studies using videos of social interactions when investigating attentional biases. Previous literature has found that gaze patterns differ when comparing social interaction studies and computer-based experiments (Laidlaw et al., 2011; Lidle & Schmitz, 2022), as well as between dynamic and social simulation tasks (Blais et al., 2017). Thus, our results extend previous findings in terms of both generalizability, as videos are more depictive of real-life scenarios, as well as showing an overall initial vigilance towards dynamic stimuli in anxious individuals.

Our results also suggest that those with increased anxiety symptoms spend more time gazing at negative videos over neutral ones, highlighting that anxious individuals may display a negative attentional bias on our dwell time index. Similarly, many studies have suggested that those with anxiety have impaired attention control, resulting in anxious individuals struggling to fixate away from (i.e., disengage attention from) negative stimuli (Derryberry & Reed, 2002; Waters et al., 2010). This ultimately increases attentional maintenance towards threatening content, particularly during the later stages of information processing (Bardeen & Daniel, 2017; Clauss et al., 2022). A recent meta-analysis corroborates these findings, as Clauss et al. (2022) found that anxiety, as well as fear-related symptoms, were significantly associated with the maintenance of attention on threat-related stimuli (Clauss et al., 2022).

In contrast, various studies have also found support for the “vigilance-avoidance” hypothesis, where once individuals initially allocate more attention towards the threat, they subsequently avoid the stimuli (Armstrong & Olatunji, 2012; Högström et al., 2019; Reichenberger et al., 2020). However, vigilance-avoidance behaviours may be dependent upon the age of participants. A recent meta-analysis suggests that, while children display attentional avoidance of threatening stimuli, adolescents, youth, and adults do not (Lisk et al., 2020).

Research regarding anxious adults suggests they have difficulty disengaging from negative stimuli (Lisk et al., 2020). Taking this into consideration, as our sample included emerging adults, they are likely to display attentional maintenance towards negative stimuli.

Further, Clauss et al. (2022) suggest that attentional maintenance towards negative stimuli may be stronger at longer stimulus durations, potentially due to the poor reliability of dwell time at shorter durations (Clauss et al., 2022). Moreover, evidence suggests that deficits in top-down attentional processing, which is goal-driven, may become more prominent during longer stimulus durations in those with anxiety, resulting in increased attention towards negative stimuli (Clauss et al., 2022; Eysenck et al., 2007). Importantly, the current study used 30-second video clips as our stimuli duration, which would be considered a longer stimulus duration in the literature as it is > 2000 ms (Clauss et al., 2022)

Interestingly, when shown positive-negative pairings, no differences in dwell time or number of fixations were found; our anxious participants' difficulties disengaging attention from negative stimuli were restricted to the negative-neutral pairings. Previous research suggests that attentional processes are biased towards emotional stimuli, regardless of the type of emotion (Nummenmaa et al., 2006). A previous study found that individuals are more likely to first fixate, and gaze longer, on emotional visual stimuli over neutral stimuli; this is also known as the emotionality hypothesis (Nummenmaa et al., 2006). As such, when the participants of our study were shown two emotional videos at once, they may have similarly divided their attention between the two emotionally valent videos, irrespective of anxiety severity and type of video. To our knowledge, most attentional bias studies, particularly those using the dot-probe task, use negative-neutral or positive-neutral pairings (Roy et al., 2008; Thigpen et al., 2018), not positive-negative. Thus, our research extends previous findings, suggesting that negative attentional

biases in youth with anxiety may not be as prominent when shown positive, dynamic stimuli that are competing for their attention.

Further, we observed an inverse association between anxiety severity and social competence, suggesting that as anxiety symptoms increase, interpersonal competence decreases. These results replicate many prior studies (de Lijster et al., 2018; Kreuze et al., 2018). However, we did not find any support that negative attentional biases are a mechanism contributing to poor social competence among anxious youth. Therapeutically, this means that social competence needs in socially anxious emerging adults should be tackled in ways other than through attention bias modification (ABM) training. For example, a social skills training module could be included in CBT programs or added to ABM to tackle both problems that may result from and contribute to anxiety in emerging adults.

Overall, our findings suggest that social videos can be used in future research to help disentangle the cognitive mechanisms behind attention biases and anxiety, specifically in emerging adults. Further, these results suggest that alternative treatments, ABM training, should be developed and used in conjunction with more traditional methods to lower negative attentional biases and anxiety severity. Importantly, our methods could be employed on a case-by-case basis for emerging adults with anxiety to help decide who would potentially benefit from ABM training as not every individual with anxiety displays this bias. For example, anxious individuals who display a negative attention bias may be asked to participate in ABM-threat-avoidance training. This would involve responding to a probe that appears in a different location than the threat-related stimuli – ultimately training the individual to orient their attention away from negative stimuli and toward alternative stimuli (Bar-Haim, 2010; Mogg et al., 2017).

Excitingly, previous meta-analyses have demonstrated that ABM treatments have reduced both threat-related biases and anxiety symptoms (Hakamata et al., 2010; Pettit et al., 2020).

2.4.1. Strengths and Limitations

There are several limitations associated with this research study. First, our study is slightly underpowered and as a result, there may be statistically significant results that we did not detect. While we had 69 participants, 7 participants withdrew, leaving the study somewhat underpowered for detecting interactions which are often smaller than the main effects. Not adjusting for multiple testing should also be considered a limitation as we increased our risk for Type I errors (i.e., finding false significance) (Feise, 2002). Further, as our population is exclusively female, our results may not be generalizable towards males. Our sample is also only English-speaking individuals from the local Halifax Regional Municipality area and thus may not be representative of the larger population (e.g., Canadian youth). We also employed various questionnaires and while we expected participants to be truthful when answering these questionnaires, that may not always have been the case. On the other hand, self-reported questionnaires are widely used in research settings (Thombs et al., 2018) and all questionnaires we chose have shown satisfactory psychometric properties. We also used various procedures to maximize honest reporting (e.g., assuring confidentiality, allowing privacy for completion, and ensuring there were no negative consequences for answering honestly). While we planned to have the dynamic video stimuli be as relatable as possible to our population, all participants may not have related to all the content. To account for this limitation, we asked three individuals within our target age group (18-24 years old; i.e., our youth advisory) their opinions regarding the video stimuli to ensure they showed the proper emotional content. Thus, the content of our stimuli may also be considered a strength.

One major strength of our study includes the use of modern eye-tracking technology to assess attentional biases. As previously mentioned, the dot-probe task is often used in attentional bias research, which is limited in its ability to assess attention maintenance and/or attention shifts when viewing visually complex stimuli over longer durations (Jiang & Vartanian, 2018; Kappenman et al., 2014). As such, the use of eye-tracking in the current study enabled us to investigate not only initial orientation, but also how many fixations they made on each video and how long participants dwelled on dynamic stimuli. The use of dynamic, social stimuli is also a strength of the current project as videos are more depictive of real-life scenarios in comparison to the static photos commonly used in research in this field.

2.4.2. Future Directions

While the current study assessed attention biases with social videos, future studies would benefit from investigating potential attentional biases in real-life scenarios. The use of a mobile, head-mounted eye-tracking device could be used when interacting with others in a positive or negative manner (such as discussing one's accomplishments or failures) to assess eye movements during periods of communication. The same method could also be used with participants when they view social scenes in-person, such as watching others interact, or through a virtual reality headset that mimics social interactions. This would allow researchers and other health professionals to further understand attentional biases in real-life scenarios. In addition, as we used self-reported measures of anxiety, future studies may benefit from assessing those clinically diagnosed with and without an anxiety disorder. Also, due to our purposely restricted sample (female emerging adults), future studies should include a more diverse sample, including males and those who do not identify on the gender binary, as well as multi-site studies to increase the generalizability of results.

2.4.3. Conclusions

We used modern eye-tracking software to assess attentional biases in emerging adults with anxiety using dynamic, social stimuli. This study provides exciting evidence that female, emerging adults with increased anxiety may orient their attention faster, regardless of content, in comparison to those with lower anxiety severity. While all participants displayed an attentional orienting bias towards emotional stimuli over neutral stimuli, we did demonstrate that as anxiety severity increased, time spent gazing at negative videos (in negative-neutral pairings) increased as well. These results suggest that anxious female emerging adults may display an initial vigilance towards dynamic social stimuli, which then may lead to them spending more time dwelling on threatening and/or negative videos. This novel study will assist in standardizing the use of social videos in eye-tracking research with anxious emerging adults. Lastly, this research project may ultimately contribute to the development of new therapeutic techniques, such as training to alter one's negative attentional bias, to help affected emerging adults conquer their anxiety.

CHAPTER 3. GENERAL DISCUSSION

In this Masters' thesis, we aimed to develop a better understanding of the cognitive mechanisms behind anxiety disorders and to help bridge the gap of knowledge surrounding how anxiety and attentional biases may impact social competence in emerging adults. To our knowledge, this is one of the first studies that used modern eye-tracking equipment to assess attentional biases using dynamic videos of social interactions. Previous research has shown that those with greater anxiety severity not only partake in vigilance behaviours in order to determine the degree of threat in the environment but also have difficulty gazing away from negative stimuli (Bar-Haim et al., 2007; Beck & Clark, 1997; Clauss et al., 2022; Derryberry & Reed, 2002; Rosen et al., 2019; Waters et al., 2010). Thus, the current study hypothesized that (1) anxious emerging adults would fixate more quickly on negative, dynamic stimuli in comparison to their healthy peers, (2) higher anxiety symptoms would be associated with increased dwell time on negative dynamic social stimuli, and (3) the inverse relationship between anxiety symptoms and interpersonal competence would be mediated by (explained by) dwell time on the negative social videos.

Our first hypothesis was partially supported. Anxious emerging adults did not fixate quicker towards negative stimuli, but rather they oriented their gaze faster towards the video stimuli in general, regardless of the video's emotional content. Our second hypothesis was supported as an increase in anxiety symptoms resulted in an increase of dwell time on negative videos in negative-neutral pairings, ultimately suggesting youth may have a negative attentional bias during longer stimuli presentations. Lastly, despite previous research suggesting that anxiety is negatively associated with interpersonal competence (Metts et al., 2023), which we did

replicate in our study, our third hypothesis was not supported as negative attentional biases did not mediate the inverse relationship between anxiety severity and interpersonal competence.

While our findings suggest that anxious emerging adults' negative attentional bias is unrelated to our measure of social competence, this should not be taken to suggest that negative attentional biases do not influence interpersonal relationships in a young person's life. Indeed, socially anxious individuals have previously been shown to interpret social interactions more negatively than their healthy peers. Those with high anxiety also ruminate and focus on past failures and negative evaluations of themselves, and believe others negatively evaluate them more so than non-anxious individuals (Clark & Wells, 1995; Hofmann, 2007). This maladaptive strategy of constantly focusing on negative aspects of one's environment has been linked to further interpersonal distress – creating a vicious cycle in which negative attentional biases influence one's focus, ultimately maintaining and increasing anxiety symptoms (Burris et al., 2019; Morales et al., 2016; Roy et al., 2008).

3.1. Clinical Implications

Despite recent advances in attentional bias research, the cognitive mechanisms behind attentional biases in those with anxiety remain unclear (Armstrong & Olatunji, 2012). Further, most studies use static images when investigating attention; however, it has been suggested that visual attention processes may differ when viewing static versus dynamic stimuli (Blais et al., 2017; Laidlaw et al., 2011; Lidle & Schmitz, 2022). Even though these differences have been observed, no studies, to our knowledge, have examined the effect of anxiety severity on attentional biases using videos specifically depicting social interactions. Thus, in its design, the current study is breaking new ground. Importantly, not only will this study help standardize the

use of social videos in attention research, but it may eventually lead to the use of videos in attention bias modification (ABM) techniques.

More specifically, ABM involves re-training attentional focus in anxious individuals towards non-threatening stimuli (Clauss et al., 2022). The procedure is typically delivered through an electronic device, such as a computer or app-based design, that can be used from the comfort of an individual's home (Niles et al., 2020). In brief, ABM involves a modified version of the dot-probe task, where researchers and clinicians nearly always replace the probe with a neutral or positive stimulus, ultimately redirecting the participant's attention away from negative stimuli (Heeren, Mogoaşe, et al., 2015). In both meta-analyses (Hakamata et al., 2010) and reviews (Clarke et al., 2014), ABM holds promise in its ability to reduce both negative attentional bias and anxiety in adults; however, research involving the effects of ABM in anxious youth remains in its infancy (Dudeney et al., 2015).

One meta-analysis conducted by Cristea et al. (2015) found that ABM may not significantly decrease mental health problems for youth and adolescents (Cristea et al., 2015). However, this may be due to the static facial stimuli being displayed for 500ms in all of the studies included in the meta-analysis (Cristea et al., 2015; Dudeney et al., 2015). Attention biases are age-specific (Tomaszczyk & Fernandes, 2014) and biases may not be present for youth at shorter stimulus durations (Dudeney et al., 2015). Thus, the current thesis may influence ABM techniques by stimulating research using longer stimulus durations to determine if adapted ABM techniques are beneficial for anxious emerging adults.

Further, a recent meta-analysis highlighted that most stimuli in ABM procedures are static, such as facial images or words (Clauss et al., 2022). As mentioned previously, static images do not adequately depict real-life social scenarios and gaze patterns have been known to differ

between static and dynamic stimuli (Blais et al., 2017). By effectively using a set of social videos in the current research project, we hope researchers and clinicians in future studies consider using these or similar dynamic stimuli in ABM procedures to investigate the potential benefits of the treatment for those with anxiety in using more ecologically valid stimuli.

3.2. Limitations and Future Directions

There are several limitations associated with the current research study. First, while we tried to find videos that were appropriately depicting our chosen emotional categories (i.e., positive, negative, and neutral content), certain youth may have recognized or previously seen some of the clips we used. If youth had seen a video clip of a TV show or movie that they liked, they may have been more inclined to watch that video in comparison to the naïve videos or may have avoided the clip in favour of the more novel stimulus. To help combat this limitation, some of the clips were from TV shows and movies that are not popular among our restricted age group (e.g., "The Breakfast Club"). In line with the previous limitation, participants may have also recognized certain actors/actresses that they may have previous biases towards. For example, a participant may especially like the actress Ellen Pompeo (from "Grey's Anatomy") which may have led them to watch that clip over the other video being shown or vice versa if it was an actress/actor that they did not like. Future studies should focus on creating new dynamic videos that depict social interactions that participants would not have seen before to limit such potential external influences.

Moreover, we aimed to have all videos be as relatable as possible to our population; however, all participants may not have related to the content chosen. Future research would benefit from acquiring emotion ratings, such as through a validated set of visual analogue scales, from participants to ensure the videos are depicting the desired emotional content. In the current

study, we did not ask participants to rate the videos as we did not want to draw attention to the emotional content.

Anecdotally, the emotional content video clips did contain more movement than the neutral video clips. For example, certain bullying clips depicted people pushing and shoving one another, while the neutral video may have shown individuals sitting around a table eating lunch. Since visual motion is attention grabbing (Culham, 2003; Pratt et al., 2010) the increase in movement in negative and positive videos may have influenced participants to gaze towards emotional content as opposed to neutral. However, we saw an influence of anxiety on dwell time in negative-neutral pairings but not positive-neutral pairings; if anxious participants were more inclined to view the videos with more movement, the same effects for negative-neutral and positive-neutral pairings should have been observed. Thus, while the decrease of movement in neutral videos may be considered a limitation, it may not have impacted our findings extensively. Moreover, future research would benefit from the creation of new neutral videos that contain more movement to increase similarities between other aspects of video content outside of emotional valence.

Thirdly, our video pairings did not include audio, which may have limited the results. While it would be challenging to play two videos at once with audio, many social interactions involve verbal communication. As such, our results may not be as generalizable towards real-life scenarios as they would have had they contained audio cues as well as visual. Including videos with audio, but not paired on a screen, may provide important insight, and support our findings of how youth with anxiety may view social interactions. For example, a study conducted by Weeks et al. (2019) investigated whether those with social anxiety display gaze avoidance behaviours when completing a dynamic social simulation task that involved watching video clips

of actors providing positive and negative feedback towards the participant (Weeks et al., 2019). Eye-tracking methods were employed to assess gaze avoidance. While each video was shown separately, audio was included in this interactive task – thus it is possible to precisely program regions of interest around actors in video clips (Weeks et al., 2019). Incorporating this type of analysis with videos depicting social interactions involving multiple people that include audio may provide more nuanced evidence on the cognitive mechanisms with which anxious individuals view their external environment.

Another limitation of this study was the lack of consideration of depressive symptoms in our young sample. It is well known that anxiety is often co-morbid with depression (Kalin, 2020; Lamers et al., 2011; Saha et al., 2021). In a study conducted by Duque and Váquez (2015), depressed adults were found to gaze towards sad stimuli (i.e., sad faces) and gaze away from positive stimuli (i.e., happy faces) in comparison to healthy controls (Duque & Vázquez, 2015). Meta-analyses corroborate these findings, and research further suggests that this negative attentional bias in those with depression is not severely affected by stimulus type (i.e*.,* verbal (emotional words) or non-verbal (emotional pictures)) (Peckham et al., 2010; Suslow et al., 2020). Importantly, when female youth, wearing eye-tracking glasses, were asked to give a speech in front of a judge in a live, social environment, those with high levels of depressive symptoms were found to look at the critical judge more often than the positive judge, suggesting that elevated depressive symptoms may be related to sustained attention towards negative evaluation (Woody et al., 2019). As the current study did collect data regarding participants' depressive symptoms as part of a larger, ongoing study, it would be beneficial to determine whether those with depressive symptoms or those with co-morbid anxiety and depression display different attentional patterns in comparison to those solely with anxiety.

As our population was exclusively female, our results may not be generalizable to males. While we purposely restricted our sample to females to reduce the heterogeneity within study participants to adapt to the limited sample size of our eye-tracking study, we acknowledge this is a limitation. We hope that future studies will be able to include a more diverse sample, such as males and more of those who do not identify on the gender binary, to increase the generalizability of results and to specifically study both sex and gender differences. Findings from such work may lead to important sex- or gender-matched attention behaviour modification procedures.

In addition, the age range of the current study should be considered a limitation. While we aimed to investigate attentional biases in emerging adults, aged 18-24 (Arnett 2000), attentional biases have previously been shown to be age specific. Thus, our results may be more generalizable to emerging adults as opposed to other populations' (i.e., children, adolescents, etc.) anxiety problems. A previous meta-analysis found age differences for attentional biases, with younger anxious children displaying a bias for threat-related stimuli which reduced as they aged; however, in anxious youth, the negative bias persists (Dudeney et al., 2015). It would have been interesting to incorporate multiple age ranges (i.e., 10-14, 15-24, 25+) to investigate potential developmental changes in biases in those with anxiety.

Another limitation that should be considered when interpreting our results is ethnicity. Recent literature has suggested that ethnicity plays an important role in how one experiences and copes with anxiety (Jager et al., 2014). Since our sample was mainly Caucasian (68%), our results may not be generalizable to minorities who were underrepresented in the current study. Similarly, those who identify as belonging to certain minority populations may not relate to the videos we chose to measure attentional biases if their identified minority was not represented in

the content (Bocanegra et al., 2023). While our stimuli did include individuals from various ethnicities, including more diversity in stimuli, as well as having a more diverse study population, is important in future studies to investigate potential sociodemographic factors that may aid in the development of ABM techniques.

We also employed self-questionnaires to assess anxiety, which may be considered a limitation. While we expect participants to be truthful when answering these questionnaires, that may not always be the case due to several biases, such as social desirability biases and/or retrospective memory biases (Althubaiti, 2016). Further, self-reported questionnaires are widely used in research settings (Thombs et al., 2018), and all questionnaires we chose have shown satisfactory psychometric properties. We also used various measures, such as assuring confidentiality and privacy, to maximize honest reporting. Additionally, including clinical samples in future studies would provide important insight into whether those diagnosed with anxiety differ from those with self-reported anxiety symptoms (Clauss et al., 2022).

Moreover, we did not correct for multiple testing due to the novel nature of the current study, which may have resulted in an increase in finding false significance (i.e., Type I error) (Feise, 2002). Lastly, while we had an impressive 62 participants with complete data, the current study was still somewhat underpowered. Our power analysis indicated that to achieve 80% power with a moderate effect size of 0.47 (alpha set to 0.05), we would need 74 emerging adults. It is possible that, while we did not find the three-way interactions between Anxiety, Pairings, and Video Type in the time to first fixations and the number of fixations data to be significant, they may be statistically significant – we were simply unable to detect the effect due to our smaller sample size (N=62). Thus, more participants need to be added to this study to ensure the results are appropriately powered. Future studies should also be run with a larger sample size.

3.3. Conclusions

This Masters' thesis provides exciting evidence that anxious youth display attentional vigilance responses towards dynamic, social stimuli, regardless of emotional content. Novel results from our findings also suggest that an increase in anxiety symptoms is associated with an increase in dwell time for negative videos when viewing negative-neutral pairings – highlighting that those with anxiety may have a negative attentional bias when viewing social situations involving difficulty shifting attention away from negative stimuli over time. Interestingly, no bias was found when youth watched positive-negative pairings, potentially suggesting that the presence of competing positive videos may negate this effect. The observed inverse relationship observed between anxiety and interpersonal competence was not mediated by negative attentional biases in this sample. Importantly, as current research surrounding anxiety disorders and social attention focuses primarily on static images of social scenes, the current thesis has extended upon previous literature by incorporating modern eye-tracking equipment to assess attentional biases using social videos, as such videos might better reflect the dynamic nature of social scenes in real-life.

Nova Scotia has previously reported having the highest age-standardized use of various health services to help combat anxiety and other psychological disorders in Canada (McRae et al., 2016). Consequently, it is important to continuously research and develop new treatments for those with anxiety disorders. This research project might advance interventions, in combination with current treatments, that are cost-effective and easily accessible. Excitingly, the current research project's results will help guide the planned development of an app-based attentional bias modification technique that may ultimately improve the quality of life among those youth suffering from anxiety disorders.

REFERENCES

Aktar, E., Nimphy, C. A., Kret, M. E., Pérez-Edgar, K., Raijmakers, M. E. J., & Bögels, S. M. (2022). Attention biases to threat in infants and parents: Links to parental and infant anxiety dispositions.. *Research on Child and Adolescent Psychopathology*, *50*(3), 387–402. https://doi.org/10.1007/s10802-021-00848-3

Alegría, M., NeMoyer, A., Falgàs Bagué, I., Wang, Y., & Alvarez, K. (2018). Social determinants of mental health: Where we are and where we need to go. *Current Psychiatry Reports*, *20*(11), 95. https://doi.org/10.1007/s11920-018-0969-9

Allen, N. B., & Badcock, P. B. T. (2003). The social risk hypothesis of depressed mood: Evolutionary, psychosocial, and neurobiological perspectives. *Psychological Bulletin*, *129*(6), 887–913. https://doi.org/10.1037/0033-2909.129.6.887

Althubaiti, A. (2016). Information bias in health research: Definition, pitfalls, and adjustment methods. *Journal of Multidisciplinary Healthcare*, *9*, 211–217. https://doi.org/10.2147/JMDH.S104807

Angulo, M., Rooks, B. T., Gill, M., Goldstein, T., Sakolsky, D., Goldstein, B., Monk, K., Hickey, M. B., Diler, R. S., Hafeman, D., Merranko, J., Axelson, D., & Birmaher, B. (2017). Psychometrics of the screen for adult anxiety related disorders (SCAARED)- A new scale for the assessment of DSM-5 anxiety disorders. *Psychiatry Research*, *253*, 84–90. https://doi.org/10.1016/j.psychres.2017.02.034

Arab, A., El Keshky, M., & Hadwin, J. A. (2016). Psychometric properties of the screen for child anxiety related emotional disorders (SCARED) in a non-clinical sample of children and adolescents in Saudi Arabia. *Child Psychiatry and Human Development*, *47*, 554–562. https://doi.org/10.1007/s10578-015-0589-0

Arch, J. J., & Craske, M. G. (2009). First-line treatment: A critical appraisal of cognitive behavioral therapy developments and alternatives. *Psychiatric Clinics*, *32*(3), 525–547. https://doi.org/10.1016/j.psc.2009.05.001

Armstrong, T., & Olatunji, B. O. (2012). Eye tracking of attention in the affective disorders: A meta-analytic review and synthesis. *Clinical Psychology Review*, *32*(8), 704–723. https://doi.org/10.1016/j.cpr.2012.09.004

Arnett, J. J. (2000). Emerging adulthood: A theory of development from the late teens through the twenties. *American Psychologist*, *55*(5), 469–480. https://doi.org/10.1037/0003-066X.55.5.469

Asher, M., & Aderka, I. M. (2018). Gender differences in social anxiety disorder. *Journal of Clinical Psychology*, *74*(10), 1730–1741. https://doi.org/10.1002/jclp.22624

Bandelow, B. (2020). Current and Novel Psychopharmacological Drugs for Anxiety Disorders. In Y.-K. Kim (Ed.), *Anxiety Disorders: Rethinking and Understanding Recent Discoveries* (pp. 347–365). Springer. https://doi.org/10.1007/978-981-32-9705-0_19

Bandelow, B., Michaelis, S., & Wedekind, D. (2017). Treatment of anxiety disorders. *Dialogues in Clinical Neuroscience*, *19*(2), 93–107. https://doi.org/10.31887/DCNS.2017.19.2/bbandelow

Bangee, M., Harris, R. A., Bridges, N., Rotenberg, K. J., & Qualter, P. (2014). Loneliness and attention to social threat in young adults: Findings from an eye tracker study. *Personality and Individual Differences*, *63*, 16–23. https://doi.org/10.1016/j.paid.2014.01.039

Bantin, T., Stevens, S., Gerlach, A. L., & Hermann, C. (2016). What does the facial dot-probe task tell us about attentional processes in social anxiety? A systematic review. *Journal of Behavior Therapy and Experimental Psychiatry*, *50*, 40–51. https://doi.org/10.1016/j.jbtep.2015.04.009

Bardeen, J. R., & Daniel, T. A. (2017). A longitudinal examination of the role of attentional control in the relationship between posttraumatic stress and threat-related attentional bias: An eye-tracking study. *Behaviour Research and Therapy*, *99*, 67–77. https://doi.org/10.1016/j.brat.2017.09.003

Bar-Haim, Y. (2010). Research review: Attention bias modification (ABM): a novel treatment for anxiety disorders. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *51*(8), 859–870. https://doi.org/10.1111/j.1469-7610.2010.02251.x

Bar-Haim, Y., Lamy, D., Pergamin, L., Bakermans-Kranenburg, M. J., & van IJzendoorn, M. H. (2007). Threat-related attentional bias in anxious and nonanxious individuals: A meta-analytic study. *Psychological Bulletin*, *133*, 1–24. https://doi.org/10.1037/0033-2909.133.1.1

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173–1182. https://doi.org/10.1037/0022-3514.51.6.1173

Baxter, A. J., Scott, K. M., Vos, T., & Whiteford, H. A. (2013). Global prevalence of anxiety disorders: A systematic review and meta-regression. *Psychological Medicine*, *43*(5), 897–910. https://doi.org/10.1017/S003329171200147X

Beck, A. T., & Clark, D. A. (1997). An information processing model of anxiety: Automatic and strategic processes. *Behaviour Research and Therapy*, *35*(1), 49–58. https://doi.org/10.1016/S0005-7967(96)00069-1

Becker, E. S., Rinck, M., Margraf, J., & Roth, W. T. (2001). The emotional Stroop effect in anxiety disorders General emotionality or disorder specificity? *Anxiety Disorders*.

Beesdo, K., Knappe, S., & Pine, D. S. (2009). Anxiety and anxiety disorders in children and adolescents: Developmental issues and implications for DSM-V. *The Psychiatric Clinics of North America*, *32*(3), 483. https://doi.org/10.1016/j.psc.2009.06.002

Bekhtereva, V., & Müller, M. M. (2017). Bringing color to emotion: The influence of color on attentional bias to briefly presented emotional images. *Cognitive, Affective, & Behavioral Neuroscience*, *17*(5), 1028–1047. https://doi.org/10.3758/s13415-017-0530-z

Ben-Haim, M. S., Williams, P., Howard, Z., Mama, Y., Eidels, A., & Algom, D. (2016). The emotional Stroop task: Assessing cognitive performance under exposure to emotional content. *Journal of Visualized Experiments : JoVE*, *112*, 53720. https://doi.org/10.3791/53720

Birmaher, B., Brent, D. A., Chiappetta, L., Bridge, J., Monga, S., & Baugher, M. (1999). Psychometric properties of the Screen for Child Anxiety Related Emotional Disorders (SCARED): A replication study. *Journal of the American Academy of Child and Adolescent Psychiatry*, *38*(10), 1230–1236. https://doi.org/10.1097/00004583-199910000-00011

Birmaher, B., Khetarpal, S., Brent, D., Cully, M., Balach, L., Kaufman, J., & Neer, S. M. (1997). The Screen for Child Anxiety Related Emotional Disorders (SCARED): Scale construction and psychometric characteristics. *Journal of the American Academy of Child & Adolescent Psychiatry*, *36*(4), 545–553. https://doi.org/10.1097/00004583-199704000-00018

Bittner, A., Egger, H. L., Erkanli, A., Costello, E. J., Foley, D. L., & Angold, A. (2007). What do childhood anxiety disorders predict? *Journal of Child Psychology and Psychiatry*, *48*(12), 1174–1183. https://doi.org/10.1111/j.1469-7610.2007.01812.x

Blais, C., Fiset, D., Roy, C., Saumure Régimbald, C., & Gosselin, F. (2017). Eye fixation patterns for categorizing static and dynamic facial expressions. *Emotion*, *17*, 1107–1119. https://doi.org/10.1037/emo0000283

Blanco, C., Rubio, J., Wall, M., Wang, S., Jiu, C. J., & Kendler, K. S. (2014). Risk factors for anxiety disorders: Common and specific effects in a national sample. *Depression and Anxiety*, *31*(9), 756–764. https://doi.org/10.1002/da.22247

Bocanegra, E. S., Chang, S. W., Rozenman, M., Lee, S. S., Delgadillo, D., & Chavira, D. A. (2023). Attention bias and anxiety: The moderating effect of sociocultural variables in rural Latinx youth. *Community Mental Health Journal*. https://doi.org/10.1007/s10597-023-01132-y

Boettcher, J., Leek, L., Matson, L., Holmes, E. A., Browning, M., MacLeod, C., Andersson, G., & Carlbring, P. (2013). Internet-based attention bias modification for social anxiety: A randomised controlled comparison of training towards negative and training towards positive Cues. *PLOS ONE*, *8*(9), e71760. https://doi.org/10.1371/journal.pone.0071760

Buckner, J. D., Maner, J. K., & Schmidt, N. B. (2010). Difficulty disengaging attention from social threat in social anxiety. *Cognitive Therapy and Research*, *34*(1), 99–105. https://doi.org/10.1007/s10608-008-9205-y

Buhrmester, D., Furman, W., Wittenberg, M. T., & Reis, H. T. (1988). Five domains of interpersonal competence in peer relationships. *Journal of Personality and Social Psychology*, *55*(6), 991–1008. https://doi.org/10.1037/0022-3514.55.6.991

Burris, J. L., Buss, K., LoBue, V., Pérez-Edgar, K., & Field, A. P. (2019). Biased attention to threat and anxiety: On taking a developmental approach. *Journal of Experimental Psychopathology*, *10*(3), 2043808719860717. https://doi.org/10.1177/2043808719860717

Bystritsky, A., Khalsa, S. S., Cameron, M. E., & Schiffman, J. (2013). Current diagnosis and treatment of anxiety disorders. *Pharmacy and Therapeutics*, *38*(1), 30–57.

Cabral, M. D., & Patel, D. R. (2020). Risk factors and prevention strategies for anxiety disorders in childhood and adolescence. In Y.-K. Kim (Ed.), *Anxiety Disorders: Rethinking and Understanding Recent Discoveries* (pp. 543–559). Springer. https://doi.org/10.1007/978-981-32-9705-0_27

Capriola-Hall, N. N., Ollendick, T. H., & White, S. W. (2020). Gaze as an indicator of selective attention in adolescents with social anxiety disorder. *Cognitive Therapy and Research*, *44*(1), 145–155. https://doi.org/10.1007/s10608-019-10038-7

Carter, R., Silverman, W. K., & Jaccard, J. (2011). Sex variations in youth anxiety symptoms: Effects of pubertal development and gender role orientation. *Journal of Clinical Child & Adolescent Psychology*, *40*(5), 730–741. https://doi.org/10.1080/15374416.2011.597082

Cisler, J. M., & Koster, E. H. W. (2010). Mechanisms of attentional biases towards threat in anxiety disorders: An integrative review. *Clinical Psychology Review*, *30*(2), 203–216. https://doi.org/10.1016/j.cpr.2009.11.003

Clark, D. M., & Wells, A. (1995). A cognitive model of social phobia. In *Social phobia: Diagnosis, assessment, and treatment* (pp. 69–93). The Guilford Press.

Clarke, P. J., Notebaert, L., & MacLeod, C. (2014). Absence of evidence or evidence of absence: Reflecting on therapeutic implementations of attentional bias modification. *BMC Psychiatry*, *14*(1), Article 1. https://doi.org/10.1186/1471-244X-14-8

Clauss, K., Gorday, J. Y., & Bardeen, J. R. (2022). Eye tracking evidence of threat-related attentional bias in anxiety- and fear-related disorders: A systematic review and meta-analysis. *Clinical Psychology Review*, *93*, 102142. https://doi.org/10.1016/j.cpr.2022.102142

Cohen, J. R., Andrews, A. R., Davis, M. M., & Rudolph, K. D. (2018). Anxiety and depression during childhood and adolescence: Testing theoretical models of continuity and discontinuity. *Journal of Abnormal Child Psychology*, *46*(6), 1295. https://doi.org/10.1007/s10802-017-0370-x

Connolly, S. D., Bernstein, G. A., & Work Group on Quality Issues. (2007). Practice parameter for the assessment and treatment of children and adolescents with anxiety disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*, *46*(2), 267–283. https://doi.org/10.1097/01.chi.0000246070.23695.06

Copeland, W. E., Angold, A., Shanahan, L., & Costello, E. J. (2014). Longitudinal patterns of anxiety from childhood to adulthood: The Great Smoky Mountains Study. *Journal of the American Academy of Child & Adolescent Psychiatry*, *53*(1), 21–33. https://doi.org/10.1016/j.jaac.2013.09.017

Coroiu, A., Meyer, A., Gomez-Garibello, C. A., Brähler, E., Hessel, A., & Körner, A. (2015). Brief form of the Interpersonal Competence Questionnaire (ICQ-15): Development and preliminary validation with a German population sample. *European Journal of Psychological Assessment*, *31*(4), 272–279. https://doi.org/10.1027/1015-5759/a000234

COVID-19 Mental Disorders Collaborators. (2021). Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. *Lancet (London, England)*, *398*(10312), 1700–1712. https://doi.org/10.1016/S0140-6736(21)02143-7

Creswell, C., Waite, P., & Hudson, J. (2020). Practitioner Review: Anxiety disorders in children and young people – assessment and treatment. *Journal of Child Psychology and Psychiatry*, *61*(6), 628–643. https://doi.org/10.1111/jcpp.13186

Cristea, I. A., Mogoaşe, C., David, D., & Cuijpers, P. (2015). Practitioner Review: Cognitive bias modification for mental health problems in children and adolescents: a meta-analysis. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *56*(7), 723–734. https://doi.org/10.1111/jcpp.12383

Crocq, M.-A. (2017). The history of generalized anxiety disorder as a diagnostic category. *Dialogues in Clinical Neuroscience*, *19*(2), 107–116.

Culham, J. (2003). Attention-Grabbing motion in the human brain. *Neuron*, *40*(3), 451–452. https://doi.org/10.1016/S0896-6273(03)00689-5

Daniali, H., Martinussen, M., & Flaten, M. A. (2023). A global meta-analysis of depression, anxiety, and stress before and during COVID-19. *Health Psychology*, *42*, 124–138. https://doi.org/10.1037/hea0001259

de Lijster, J. M., Dieleman, G. C., Utens, E. M. W. J., Dierckx, B., Wierenga, M., Verhulst, F. C., & Legerstee, J. S. (2018). Social and academic functioning in adolescents with anxiety disorders: A systematic review. *Journal of Affective Disorders*, *230*, 108–117. https://doi.org/10.1016/j.jad.2018.01.008

Demir, M., Jaafar, J., Bilyk, N., & Mohd Ariff, M. R. (2012). Social skills, friendship and happiness: A cross-cultural investigation. *The Journal of Social Psychology*, *152*(3), 379–385. https://doi.org/10.1080/00224545.2011.591451

Derakshan, N., Eysenck, M. W., & Myers, L. B. (2007). Emotional information processing in repressors: The vigilance–avoidance theory. *Cognition & Emotion*, *21*(8), 1585–1614. https://doi.org/10.1080/02699930701499857

Derryberry, D., & Reed, M. A. (2002). Anxiety-related attentional biases and their regulation by attentional control. *Journal of Abnormal Psychology*, *111*(2), 225–236. https://doi.org/10.1037/0021-843X.111.2.225

DiMauro, J., Domingues, J., Fernandez, G., & Tolin, D. F. (2013). Long-term effectiveness of CBT for anxiety disorders in an adult outpatient clinic sample: A follow-up study. *Behaviour Research and Therapy*, *51*(2), 82–86. https://doi.org/10.1016/j.brat.2012.10.003

Dudeney, J., Sharpe, L., & Hunt, C. (2015). Attentional bias towards threatening stimuli in children with anxiety: A meta-analysis. *Clinical Psychology Review*, *40*, 66–75. https://doi.org/10.1016/j.cpr.2015.05.007

Duque, A., & Vázquez, C. (2015). Double attention bias for positive and negative emotional faces in clinical depression: Evidence from an eye-tracking study. *Journal of Behavior Therapy and Experimental Psychiatry*, *46*, 107–114. https://doi.org/10.1016/j.jbtep.2014.09.005

Essau, C. A., Lewinsohn, P. M., Olaya, B., & Seeley, J. R. (2014). Anxiety disorders in adolescents and psychosocial outcomes at age 30. *Journal of Affective Disorders*, *163*, 125–132. https://doi.org/10.1016/j.jad.2013.12.033

Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion*, *7*, 336–353. https://doi.org/10.1037/1528-3542.7.2.336

Feise, R. J. (2002). Do multiple outcome measures require p-value adjustment? *BMC Medical Research Methodology*, *2*(1), 8. https://doi.org/10.1186/1471-2288-2-8

Fu, X., & Pérez-Edgar, K. (2019). Threat-related attention bias in socioemotional development: A critical review and methodological considerations. *Developmental Review: DR*, *51*, 31–57. https://doi.org/10.1016/j.dr.2018.11.002

Gale, C., & Oakley-Browne, M. (2000). Anxiety disorder. *BMJ*, *321*(7270), 1204–1207. https://doi.org/10.1136/bmj.321.7270.1204

Gao, W., Ping, S., & Liu, X. (2020). Gender differences in depression, anxiety, and stress among college students: A longitudinal study from China. *Journal of Affective Disorders*, *263*, 292–300. https://doi.org/10.1016/j.jad.2019.11.121

Global Burden of Disease 2019 Diseases and Injuries Collaborators. (2020). Global burden of 369 diseases and injuries in 204 countries and territories, 1990-2019: A systematic analysis for the Global Burden of Disease Study 2019. *Lancet (London, England)*, *396*(10258), 1204–1222. https://doi.org/10.1016/S0140-6736(20)30925-9

Global Burden of Disease 2019 Mental Disorders Collaborators. (2022). Global, regional, and national burden of 12 mental disorders in 204 countries and territories, 1990–2019: A systematic analysis for the Global Burden of Disease Study 2019. *The Lancet Psychiatry*, *9*(2), 137–150. https://doi.org/10.1016/S2215-0366(21)00395-3

Geva, R., Zivan, M., Warsha, A., & Olchik, D. (2013). Alerting, orienting or executive attention networks: Differential patterns of pupil dilations. *Frontiers in Behavioral Neuroscience*, *7*, 145. https://doi.org/10.3389/fnbeh.2013.00145

Gogol, K., Brunner, M., Goetz, T., Martin, R., Ugen, S., Keller, U., Fischbach, A., & Preckel, F. (2014). "My Questionnaire is Too Long!" The assessments of motivational-affective constructs with three-item and single-item measures. *Contemporary Educational Psychology*, *39*(3), 188–205. https://doi.org/10.1016/j.cedpsych.2014.04.002

Gray, O. J., McFarquhar, M., & Montaldi, D. (2021). A reassessment of the pseudoneglect effect: Attention allocation systems are selectively engaged by semantic and spatial processing. *Journal of Experimental Psychology. Human Perception and Performance*, *47*(2), 223–237. https://doi.org/10.1037/xhp0000882

Hadwin, J. A., Donnelly, N., Richards, A., French, C. C., & Patel, U. (2009). Childhood anxiety and attention to emotion faces in a modified stroop task. *The British Journal of Developmental Psychology*, *27*(Pt 2), 487–494. https://doi.org/10.1348/026151008x315503

Hakamata, Y., Lissek, S., Bar-Haim, Y., Britton, J. C., Fox, N. A., Leibenluft, E., Ernst, M., & Pine, D. S. (2010). Attention bias modification treatment: A meta-analysis toward the establishment of novel treatment for anxiety. *Biological Psychiatry*, *68*(11), 982–990. https://doi.org/10.1016/j.biopsych.2010.07.021

Hale, W. W., Crocetti, E., Raaijmakers, Q. A. W., & Meeus, W. H. J. (2011). A meta-analysis of the cross-cultural psychometric properties of the Screen for Child Anxiety Related Emotional Disorders (SCARED). *Journal of Child Psychology and Psychiatry*, *52*(1), 80–90. https://doi.org/10.1111/j.1469-7610.2010.02285.x

Harris, P. A., Taylor, R., Minor, B. L., Elliott, V., Fernandez, M., O'Neal, L., McLeod, L., Delacqua, G., Delacqua, F., Kirby, J., & Duda, S. N. (2019). The REDCap consortium: Building an international community of software platform partners. *Journal of Biomedical Informatics*, *95*, 103208. https://doi.org/10.1016/j.jbi.2019.103208

Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics*, *42*(2), 377–381. https://doi.org/10.1016/j.jbi.2008.08.010

Health Canada. (2009). *Mental health: Anxiety disorders*. Government of Canada. https://www.canada.ca/en/health-canada/services/healthy-living/your-health/diseases/mental-health-anxiety-disorders.html

Heeren, A., Maurage, P., & Philippot, P. (2015). Revisiting attentional processing of non-emotional cues in social anxiety: A specific impairment for the orienting network of attention. *Psychiatry Research*, *228*(1), 136–142. https://doi.org/10.1016/j.psychres.2015.04.030

Heeren, A., Mogoașe, C., Philippot, P., & McNally, R. J. (2015). Attention bias modification for social anxiety: A systematic review and meta-analysis. *Clinical Psychology Review*, *40*, 76–90. https://doi.org/10.1016/j.cpr.2015.06.001

Hessels, R. S. (2020). How does gaze to faces support face-to-face interaction? A review and perspective. *Psychonomic Bulletin & Review*, *27*(5), 856–881. https://doi.org/10.3758/s13423-020-01715-w

Higa-McMillan, C. K., Francis, S. E., Rith-Najarian, L., & Chorpita, B. F. (2016). Evidence base update: 50 years of research on treatment for child and adolescent anxiety. *Journal of Clinical Child & Adolescent Psychology*, *45*(2), 91–113. https://doi.org/10.1080/15374416.2015.1046177

Hill, C., Waite, P., & Creswell, C. (2016). Anxiety disorders in children and adolescents. *Paediatrics and Child Health*, *26*(12), 548–553. https://doi.org/10.1016/j.paed.2016.08.007

Hofmann, S. G. (2007). Cognitive factors that maintain social anxiety disorder: A comprehensive model and its treatment implications. *Cognitive Behaviour Therapy*, *36*(4), 193–209. https://doi.org/10.1080/16506070701421313

Hofmann, S. G., Asnaani, A., Vonk, I. J. J., Sawyer, A. T., & Fang, A. (2012). The efficacy of cognitive behavioral therapy: A review of meta-analyses. *Cognitive Therapy and Research*, *36*(5), 427–440. https://doi.org/10.1007/s10608-012-9476-1

Högström, J., Nordh, M., Lindal, M. L., Taylor, E., Serlachius, E., & Kleberg, J. L. (2019). Visual attention to emotional faces in adolescents with social anxiety disorder receiving cognitive behavioral therapy. *PLOS ONE*, *14*(11), e0225603. https://doi.org/10.1371/journal.pone.0225603

Hu, C., Oei, T. P., Huang, Q., & Zhou, R. (2021). Early vigilance and improved processing efficiency to the test-related target in test anxiety: Evidence from the visual search task and eye-movements. *Current Psychology*. https://doi.org/10.1007/s12144-021-02454-4

Jackson, M., Kiernan, K., & McLanahan, S. (2017). Maternal education, changing family circumstances, and children's skill development in the United States and UK. *The Annals of the American Academy of Political and Social Science*, *674*(1), 59–84. https://doi.org/10.1177/0002716217729471

Jager, P. D., Suliman, S., & Seedat, S. (2014). Role of ethnicity in social anxiety disorder: A cross-sectional survey among health science students. *World Journal of Clinical Cases : WJCC*, *2*(7), 265–271. https://doi.org/10.12998/wjcc.v2.i7.265

January, A. M., Casey, R. J., & Paulson, D. (2011). A meta-analysis of classroom-wide interventions to build social skills: Do they work? *School Psychology Review*, *40*, 242–256.

Jiang, M. Y. w., & Vartanian, L. R. (2018). A review of existing measures of attentional biases in body image and eating disorders research. *Australian Journal of Psychology*, *70*(1), 3–17. https://doi.org/10.1111/ajpy.12161

Kalin, N. H. (2020). The critical relationship between anxiety and depression. *American Journal of Psychiatry*, *177*(5), 365–367. https://doi.org/10.1176/appi.ajp.2020.20030305

Kanning, U. (2006). Development and Validation of a German-Language Version of the Interpersonal Competence Questionnaire (ICQ). *European Journal of Psychological Assessment*, *22*, 43. https://doi.org/10.1027/1015-5759.22.1.43

Kappenman, E. S., Farrens, J. L., Luck, S. J., & Proudfit, G. H. (2014). Behavioral and ERP measures of attentional bias to threat in the dot-probe task: Poor reliability and lack of correlation with anxiety. *Frontiers in Psychology*, *5*. https://www.frontiersin.org/articles/10.3389/fpsyg.2014.01368

Keles, B., McCrae, N., & Grealish, A. (2020). A systematic review: The influence of social media on depression, anxiety and psychological distress in adolescents. *International Journal of Adolescence and Youth*, *25*(1), 79–93. https://doi.org/10.1080/02673843.2019.1590851

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*, *62*(6), 593–602. https://doi.org/10.1001/archpsyc.62.6.593

Kessler, R. C., Chiu, W. T., Demler, O., Merikangas, K. R., & Walters, E. E. (2005). Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*, *62*(6), 617–627. https://doi.org/10.1001/archpsyc.62.6.617

Klumpp, H., & Amir, N. (2009). Examination of vigilance and disengagement of threat in social anxiety with a probe detection task. *Anxiety, Stress & Coping*, *22*(3), 283–296. https://doi.org/10.1080/10615800802449602

Kodal, A., Fjermestad, K., Bjelland, I., Gjestad, R., Öst, L.-G., Bjaastad, J. F., Haugland, B. S. M., Havik, O. E., Heiervang, E., & Wergeland, G. J. (2018). Long-term effectiveness of cognitive behavioral therapy for youth with anxiety disorders. *Journal of Anxiety Disorders*, *53*, 58–67. https://doi.org/10.1016/j.janxdis.2017.11.003

Kreuze, L. J., Pijnenborg, G. H. M., de Jonge, Y. B., & Nauta, M. H. (2018). Cognitive-behavior therapy for children and adolescents with anxiety disorders: A meta-analysis of secondary outcomes. *Journal of Anxiety Disorders*, *60*, 43–57. https://doi.org/10.1016/j.janxdis.2018.10.005

Kuckertz, J. M., & Amir, N. (2015). Attention bias modification for anxiety and phobias: Current status and future directions. *Current Psychiatry Reports*, *17*(2), 9. https://doi.org/10.1007/s11920-014-0545-x

Laidlaw, K. E. W., Foulsham, T., Kuhn, G., & Kingstone, A. (2011). Potential social interactions are important to social attention. *Proceedings of the National Academy of Sciences*, *108*(14), 5548–5553. https://doi.org/10.1073/pnas.1017022108

Lamers, F., Oppen, P. van, Comijs, H. C., Smit, J. H., Spinhoven, P., Balkom, A. J. L. M. van, Nolen, W. A., Zitman, F. G., Beekman, A. T. F., & Penninx, B. W. J. H. (2011). Comorbidity patterns of anxiety and depressive disorders in a large cohort study: The Netherlands Study of Depression and Anxiety (NESDA). *The Journal of Clinical Psychiatry*, *72*(3), 3397. https://doi.org/10.4088/JCP.10m06176blu

Lau, J. Y. F., & Waters, A. M. (2017). Annual Research Review: An expanded account of information-processing mechanisms in risk for child and adolescent anxiety and depression. *Journal of Child Psychology and Psychiatry*, *58*(4), 387–407. https://doi.org/10.1111/jcpp.12653

Lidle, L. R., & Schmitz, J. (2022). Assessing visual avoidance of faces during real-life social stress in children with social anxiety disorder: A mobile eye-tracking study. *Child Psychiatry & Human Development*. https://doi.org/10.1007/s10578-022-01383-y

Lien, N. (2001). Adolescents' proxy reports of parents' socioeconomic status: How valid are they? *Journal of Epidemiology & Community Health*, *55*(10), 731–737. https://doi.org/10.1136/jech.55.10.731

Lijster, J. M. de, Dierckx, B., Utens, E. M. W. J., Verhulst, F. C., Zieldorff, C., Dieleman, G. C., & Legerstee, J. S. (2017). The age of onset of anxiety disorders: A meta-analysis. *The Canadian Journal of Psychiatry*, *62*(4), 237–246. https://doi.org/10.1177/0706743716640757

Lin, S., Li, X., Chen, Y.-H., Gao, F., Chen, H., Hu, N.-Y., Huang, L., Luo, Z.-Y., Liu, J.-H., You, Q.-L., Yin, Y.-N., Li, Z.-L., Li, X.-W., Du, Z.-J., Yang, J.-M., & Gao, T.-M. (2018). Social isolation during adolescence induces anxiety behaviors and enhances firing activity in BLA pyramidal neurons via mGluR5 upregulation. *Molecular Neurobiology*, *55*(6), 5310–5320. https://doi.org/10.1007/s12035-017-0766-1

Lisk, S., Vaswani, A., Linetzky, M., Bar-Haim, Y., & Lau, J. Y. F. (2020). Systematic review and meta-analysis: Eye-tracking of attention to threat in child and adolescent anxiety. *Journal of the American Academy of Child & Adolescent Psychiatry*, *59*(1), 88-99.e1. https://doi.org/10.1016/j.jaac.2019.06.006

LoBue, V., Buss, K. A., Taber-Thomas, B. C., & Pérez-Edgar, K. (2017). Developmental differences in infants' attention to social and nonsocial threats. *Infancy*, *22*(3), 403–415. https://doi.org/10.1111/infa.12167

LoBue, V., & DeLoache, J. S. (2010). Superior detection of threat-relevant stimuli in infancy. *Developmental Science*, *13*(1), 221–228. https://doi.org/10.1111/j.1467-7687.2009.00872.x

Löwenberg, E. B., Aili, F., Serlachius, E., Högström, J., & Kleberg, J. L. (2020). Reduced left visual field bias for faces in adolescents with social anxiety disorder. *Cognitive Neuropsychiatry*, *25*(6), 421–434. https://doi.org/10.1080/13546805.2020.1832456

Macatee, R. J., Albanese, B. J., Schmidt, N. B., & Cougle, J. R. (2017). Attention bias towards negative emotional information and its relationship with daily worry in the context of acute stress: An eye-tracking study. *Behaviour Research and Therapy*, *90*, 96–110. https://doi.org/10.1016/j.brat.2016.12.013

Masquelier, B., Hug, L., Sharrow, D., You, D., Mathers, C., Gerland, P., & Alkema, L. (2021). Global, regional, and national mortality trends in youth aged 15–24 years between 1990 and 2019: A systematic analysis. *The Lancet Global Health*, *9*(4), e409–e417. https://doi.org/10.1016/S2214-109X(21)00023-1

McDonald, A. J., Wickens, C. M., Bondy, S. J., Elton-Marshall, T., Wells, S., Nigatu, Y. T., Jankowicz, D., & Hamilton, H. A. (2022). Age differences in the association between loneliness and anxiety symptoms during the COVID-19 pandemic. *Psychiatry Research*, *310*, 114446. https://doi.org/10.1016/j.psychres.2022.114446

McLean, C. P., Asnaani, A., Litz, B. T., & Hofmann, S. G. (2011). Gender differences in anxiety disorders: Prevalence, course of illness, comorbidity and burden of illness. *Journal of Psychiatric Research*, *45*(8), 1027–1035. https://doi.org/10.1016/j.jpsychires.2011.03.006

McNally, R. J. (2019). Attentional bias for threat: Crisis or opportunity? *Clinical Psychology Review*, *69*, 4–13. https://doi.org/10.1016/j.cpr.2018.05.005

McRae, L., O'Donnell, S., Loukine, L., Rancourt, N., & Pelletier, C. (2016). Report summary—Mood and anxiety disorders in Canada, 2016. *Health Promotion and Chronic Disease Prevention in Canada : Research, Policy and Practice*, *36*(12), 314–315.

Metts, A. V., LeBeau, R. T., Craske, M. G., & Himle, J. A. (2023). Perceived interpersonal competence as a predictor of clinical outcomes in a randomized controlled trial for social anxiety and employment. *Cognitive Behaviour Therapy*, *52*(2), 146–162. https://doi.org/10.1080/16506073.2022.2137578

Miers, A. C., Blöte, A. W., de Rooij, M., Bokhorst, C. L., & Westenberg, P. M. (2013). Trajectories of social anxiety during adolescence and relations with cognition, social competence, and temperament. *Journal of Abnormal Child Psychology*, *41*(1), 97–110. https://doi.org/10.1007/s10802-012-9651-6

Mogg, K., Bradley, B., Miles, F., & Dixon, R. (2004). BRIEF REPORT Time course of attentional bias for threat scenes: Testing the vigilance-avoidance hypothesis. *Cognition and Emotion*, *18*(5), 689–700. https://doi.org/10.1080/02699930341000158

Mogg, K., & Bradley, B. P. (1998). A cognitive-motivational analysis of anxiety. *Behaviour Research and Therapy*, *36*(9), 809–848. https://doi.org/10.1016/s0005-7967(98)00063-1

Mogg, K., & Bradley, B. P. (2016). Anxiety and attention to threat: Cognitive mechanisms and treatment with attention bias modification. *Behaviour Research and Therapy*, *87*, 76–108. https://doi.org/10.1016/j.brat.2016.08.001

Mogg, K., Waters, A. M., & Bradley, B. P. (2017). Attention bias modification (ABM): Review of effects of multisession ABM training on anxiety and threat-related attention in high-anxious individuals. *Clinical Psychological Science*, *5*(4), 698–717. https://doi.org/10.1177/2167702617696359

Morales, S., Fu, X., & Pérez-Edgar, K. E. (2016). A developmental neuroscience perspective on affect-biased attention. *Developmental Cognitive Neuroscience*, *21*, 26–41. https://doi.org/10.1016/j.dcn.2016.08.001

Mullane, J. C., Lawrence, M. A., Corkum, P. V., Klein, R. M., & McLaughlin, E. N. (2016). The development of and interaction among alerting, orienting, and executive attention in children. *Child Neuropsychology*, *22*(2), 155–176. https://doi.org/10.1080/09297049.2014.981252

Murray, L., Creswell, C., & Cooper, P. J. (2009). The development of anxiety disorders in childhood: An integrative review. *Psychological Medicine*, *39*(9), 1413–1423. https://doi.org/10.1017/S0033291709005157

Nakagawa, A., & Sukigara, M. (2012). Difficulty in disengaging from threat and temperamental negative affectivity in early life: A longitudinal study of infants aged 12–36 months. *Behavioral and Brain Functions*, *8*(1), 40. https://doi.org/10.1186/1744-9081-8-40

Nangle, D. W., Erdley, C. A., Newman, J. E., Mason, C. A., & Carpenter, E. M. (2003). Popularity, friendship quantity, and friendship quality: Interactive influences on children's loneliness and depression. *Journal of Clinical Child & Adolescent Psychology*, *32*(4), 546–555. https://doi.org/10.1207/S15374424JCCP3204_7

Niles, A. N., Woolley, J. D., Tripp, P., Pesquita, A., Vinogradov, S., Neylan, T. C., & O'Donovan, A. (2020). Randomized controlled trial testing mobile-based attention-bias modification for posttraumatic stress using personalized word stimuli. *Clinical Psychological Science*, *8*(4), 756–772. https://doi.org/10.1177/2167702620902119

Nozadi, S. S., Spinrad, T. L., Johnson, S. P., & Eisenberg, N. (2018). Relations of emotion-related temperamental characteristics to attentional biases and social functioning. *Emotion (Washington, D.C.)*, *18*(4), 481–492. https://doi.org/10.1037/emo0000360

Nummenmaa, L., Hyönä, J., & Calvo, M. (2006). Eye movement assessment of selective attentional capture by emotional pictures. *Emotion (Washington, D.C.)*, *6*, 257–268. https://doi.org/10.1037/1528-3542.6.2.257

Ohannessian, C. M., Milan, S., & Vannucci, A. (2017). Gender differences in anxiety trajectories from middle to late adolescence. *Journal of Youth and Adolescence*, *46*(4), 826–839. https://doi.org/10.1007/s10964-016-0619-7

O'Neil Rodriguez, K. A., & Kendall, P. C. (2014). Suicidal ideation in anxiety-disordered youth: Identifying predictors of risk. *Journal of Clinical Child and Adolescent Psychology : The Official Journal for the Society of Clinical Child and Adolescent Psychology, American Psychological Association, Division 53*, *43*(1), 51–62. https://doi.org/10.1080/15374416.2013.843463

Ozbay, F., Johnson, D. C., Dimoulas, E., Morgan, C. A., Charney, D., & Southwick, S. (2007). Social support and resilience to stress. *Psychiatry (Edgmont)*, *4*(5), 35–40.

Patridge, E. F., & Bardyn, T. P. (2018). Research Electronic Data Capture (REDCap). *Journal of the Medical Library Association : JMLA*, *106*(1), 142–144. https://doi.org/10.5195/jmla.2018.319

Peckham, A. D., McHugh, R. K., & Otto, M. W. (2010). A meta-analysis of the magnitude of biased attention in depression. *Depression and Anxiety*, *27*(12), 1135–1142. https://doi.org/10.1002/da.20755

Pérez-Edgar, K., Martin McDermott, J. N., Korelitz, K., Degnan, K. A., Curby, T. W., Pine, D. S., & Fox, N. A. (2010). Patterns of sustained attention in infancy shape the developmental trajectory of social behavior from toddlerhood through adolescence. *Developmental Psychology*, *46*(6), 1723–1730. https://doi.org/10.1037/a0021064

Pérez-Edgar, K., Taber-Thomas, B., Auday, E., & Morales, S. (2014). Temperament and attention as core mechanisms in the early emergence of anxiety. *Contributions to Human Development*, *26*, 42–56. https://doi.org/10.1159/000354350

Petersen, S. E., & Posner, M. I. (2012). The attention system of the human brain: 20 years after. *Annual Review of Neuroscience*, *35*(1), 73–89. https://doi.org/10.1146/annurev-neuro-062111-150525

Pettit, J. W., Bechor, M., Rey, Y., Vasey, M. W., Abend, R., Pine, D. S., Bar-Haim, Y., Jaccard, J., & Silverman, W. K. (2020). A randomized controlled trial of attention bias modification treatment in youth with treatment-resistant anxiety disorders. *Journal of the American Academy of Child & Adolescent Psychiatry*, *59*(1), 157–165. https://doi.org/10.1016/j.jaac.2019.02.018

Posner, M. I., & Rothbart, M. K. (2000). Developing mechanisms of self-regulation. *Development and Psychopathology*, *12*(3), 427–441. https://doi.org/10.1017/S0954579400003096

Posner, M. I., & Rothbart, M. K. (2007). *Educating the human brain.* American Psychological Association. https://doi.org/10.1037/11519-000

Pratt, J., Radulescu, P. V., Guo, R. M., & Abrams, R. A. (2010). It's alive! Animate motion captures visual attention. *Psychological Science*, *21*(11), 1724–1730. https://doi.org/10.1177/0956797610387440

Puliafico, A. C., & Kendall, P. C. (2006). Threat-related attentional bias in anxious youth: A review. *Clinical Child and Family Psychology Review*, *9*(3), 162–180. https://doi.org/10.1007/s10567-006-0009-x

Qualter, P., Rotenberg, K., Barrett, L., Henzi, P., Barlow, A., Stylianou, M., & Harris, R. A. (2013). Investigating hypervigilance for social threat of lonely children. *Journal of Abnormal Child Psychology*, *41*(2), 325–338. https://doi.org/10.1007/s10802-012-9676-x

Racine, N., McArthur, B. A., Cooke, J. E., Eirich, R., Zhu, J., & Madigan, S. (2021). Global prevalence of depressive and anxiety symptoms in children and adolescents during COVID-19: A meta-analysis. *JAMA Pediatrics*, *175*(11), 1142–1150. https://doi.org/10.1001/jamapediatrics.2021.2482

Radetzki, P. A., Deleurme, K. A., & Rogers, S. M. (2022). The implications of high-conflict divorce on adult–children: Five factors related to well-being. *Journal of Family Studies*, *28*(3), 801–821. https://doi.org/10.1080/13229400.2020.1754277

Raharjanti, N. W., Wiguna, T., Purwadianto, A., Soemantri, D., Indriatmi, W., Poerwandari, E. K., Mahajudin, M. S., Nugrahadi, N. R., Roekman, A. E., Saroso, O. J. D. A., Ramadianto, A. S., & Levania, M. K. (2022). Translation, validity and reliability of decision style scale in forensic psychiatric setting in Indonesia. *Heliyon*, *8*(7), e09810. https://doi.org/10.1016/j.heliyon.2022.e09810

Ranta, K., La Greca, A. M., Kaltiala-Heino, R., & Marttunen, M. (2016). Social phobia and educational and interpersonal impairments in adolescence: A prospective study. *Child Psychiatry & Human Development*, *47*(4), 665–677. https://doi.org/10.1007/s10578-015-0600-9

Rapee, R. M., & Heimberg, R. G. (1997). A cognitive-behavioral model of anxiety in social phobia. *Behaviour Research and Therapy*, *35*(8), 741–756. https://doi.org/10.1016/S0005-7967(97)00022-3

Ravindran, A. V., & da Silva, T. L. (2013). Complementary and alternative therapies as add-on to pharmacotherapy for mood and anxiety disorders: A systematic review. *Journal of Affective Disorders*, *150*(3), 707–719. https://doi.org/10.1016/j.jad.2013.05.042

Reichenberger, J., Pfaller, M., & Mühlberger, A. (2020). Gaze behavior in social fear conditioning: An eye-tracking study in virtual reality. *Frontiers in Psychology*, *11:35*. https://www.frontiersin.org/articles/10.3389/fpsyg.2020.00035

Remes, O., Brayne, C., van der Linde, R., & Lafortune, L. (2016). A systematic review of reviews on the prevalence of anxiety disorders in adult populations. *Brain and Behavior*, *6*(7), e00497. https://doi.org/10.1002/brb3.497

Reynolds, C. R., & Richmond, B. O. (1985). *Revised Children's Manifest Anxiety Scale (RCMAS).* Los Angeles, CA: Western Psychological Services.

Reynolds, G. D., & Roth, K. C. (2018). The development of attentional biases for faces in infancy: A developmental systems perspective. *Frontiers in Psychology*, *9:222*. https://www.frontiersin.org/articles/10.3389/fpsyg.2018.00222

Robins, R. W., Hendin, H. M., & Trzesniewski, K. H. (2001). Measuring global self-esteem: Construct validation of a single-item measure and the Rosenberg Self-Esteem Scale. *Personality and Social Psychology Bulletin*, *27*(2), 151–161. https://doi.org/10.1177/0146167201272002

Roelofs, A., & Piai, V. (2011). Attention demands of spoken word planning: A review. *Frontiers in Psychology*, *2*: 307. https://www.frontiersin.org/articles/10.3389/fpsyg.2011.00307

Rosen, D., Price, R. B., & Silk, J. S. (2019). An integrative review of the vigilance-avoidance model in pediatric anxiety disorders: Are we looking in the wrong place? *Journal of Anxiety Disorders*, *64*, 79–89. https://doi.org/10.1016/j.janxdis.2019.04.003

Roy, A. K., Dennis, T. A., & Warner, C. M. (2015). A critical review of attentional threat bias and its role in the treatment of pediatric anxiety disorders. *Journal of Cognitive Psychotherapy*, *29*(3), 171–184.

Roy, A. K., Vasa, R. A., Bruck, M., Mogg, K., Bradley, B. P., Sweeney, M., Bergman, R. L., McClure-Tone, E. B., & Pine, D. S. (2008). Attention bias toward threat in pediatric anxiety disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*, *47*(10), 1189–1196. https://doi.org/10.1097/CHI.0b013e3181825ace

Roy-Charland, A., Plamondon, A., Homeniuk, A. S., Flesch, C. A., Klein, R. M., & Stewart, S. H. (2017). Attentional bias toward alcohol-related stimuli in heavy drinkers: Evidence from dynamic eye movement recording. *The American Journal of Drug and Alcohol Abuse*, *43*(3), 332–340. https://doi.org/10.1080/00952990.2016.1209511

Runyon, K., Chesnut, S. R., & Burley, H. (2018). Screening for childhood anxiety: A meta-analysis of the screen for child anxiety related emotional disorders. *Journal of Affective Disorders*, *240*, 220–229. https://doi.org/10.1016/j.jad.2018.07.049

Saha, S., Lim, C. C. W., Cannon, D. L., Burton, L., Bremner, M., Cosgrove, P., Huo, Y., & J. McGrath, J. (2021). Co-morbidity between mood and anxiety disorders: A systematic review and meta-analysis. *Depression and Anxiety*, *38*(3), 286–306. https://doi.org/10.1002/da.23113

Sahlqvist, S., Song, Y., Bull, F., Adams, E., Preston, J., Ogilvie, D., & the iConnect consortium. (2011). Effect of questionnaire length, personalisation and reminder type on response rate to a complex postal survey: Randomised controlled trial. *BMC Medical Research Methodology*, *11*(1), 62. https://doi.org/10.1186/1471-2288-11-62

Schmidtendorf, S., Wiedau, S., Asbrand, J., Tuschen-Caffier, B., & Heinrichs, N. (2018). Attentional bias in children with social anxiety disorder. *Cognitive Therapy and Research*, *42*(3), 273–288. https://doi.org/10.1007/s10608-017-9880-7

Schneider, B. H. (2009). An observational study of the interactions of socially withdrawn/anxious early adolescents and their friends. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *50*(7), 799–806. https://doi.org/10.1111/j.1469-7610.2008.02056.x

Shechner, T., Jarcho, J. M., Britton, J. C., Leibenluft, E., Pine, D. S., & Nelson, E. E. (2013). Attention bias of anxious youth during extended exposure of emotional face pairs: An eye-tracking study. *Depression and Anxiety*, *30*(1), 14–21. https://doi.org/10.1002/da.21986

Silverman, W. K., Pina, A. A., & Viswesvaran, C. (2008). Evidence-based psychosocial treatments for phobic and anxiety disorders in children and adolescents. *Journal of Clinical Child & Adolescent Psychology*, *37*(1), 105–130. https://doi.org/10.1080/15374410701817907

Singh, J. S., Capozzoli, M. C., Dodd, M. D., & Hope, D. A. (2015). The effects of social anxiety and state anxiety on visual attention: Testing the vigilance–avoidance hypothesis. *Cognitive Behaviour Therapy*, *44*(5), 377–388. https://doi.org/10.1080/16506073.2015.1016447

Smith, J. P., & Book, S. W. (2008). Anxiety and substance use disorders: A review. *The Psychiatric Times*, *25*(10), 19–23.

Solmi, M., Radua, J., Olivola, M., Croce, E., Soardo, L., Salazar de Pablo, G., Il Shin, J., Kirkbride, J. B., Jones, P., Kim, J. H., Kim, J. Y., Carvalho, A. F., Seeman, M. V., Correll, C. U., & Fusar-Poli, P. (2022). Age at onset of mental disorders worldwide: Large-scale meta-analysis of 192 epidemiological studies. *Molecular Psychiatry*, *27*(1), Article 1. https://doi.org/10.1038/s41380-021-01161-7

SR Research. (2017). *EyeLink® 1000 Plus User Manual 1.0.12*. SR Research Ltd., Mississauga, Ontario, Canada.

Statistics Canada. (2021). *Survey on COVID-19 and Mental Health, February to May 2021*. Government of Canada.

Steel, Z., Marnane, C., Iranpour, C., Chey, T., Jackson, J. W., Patel, V., & Silove, D. (2014). The global prevalence of common mental disorders: A systematic review and meta-analysis 1980–2013. *International Journal of Epidemiology*, *43*(2), 476–493. https://doi.org/10.1093/ije/dyu038

Suárez-Pellicioni, M., Núñez-Peña, M. I., & Colomé, À. (2015). Attentional bias in high math-anxious individuals: Evidence from an emotional Stroop task. *Frontiers in Psychology*, *6*, 1577. https://doi.org/10.3389/fpsyg.2015.01577

Suk, H.-J., & Irtel, H. (2010). Emotional response to color across media. *Color Research & Application*, *35*(1), 64–77. https://doi.org/10.1002/col.20554

Suslow, T., Hußlack, A., Kersting, A., & Bodenschatz, C. M. (2020). Attentional biases to emotional information in clinical depression: A systematic and meta-analytic review of eye tracking findings. *Journal of Affective Disorders*, *274*, 632–642. https://doi.org/10.1016/j.jad.2020.05.140

ter Meulen, W. G., Draisma, S., van Hemert, A. M., Schoevers, R. A., Kupka, R. W., Beekman, A. T. F., & Penninx, B. W. J. H. (2021). Depressive and anxiety disorders in concert–A synthesis of findings on comorbidity in the NESDA study. *Journal of Affective Disorders*, *284*, 85–97. https://doi.org/10.1016/j.jad.2021.02.004

Terlizzi, E. P., & Villarroel, M. A. (2020). *Symptoms of Generalized Anxiety Disorder Among Adults: United States, 2019*. https://www.cdc.gov/nchs/products/databriefs/db378.htm

Thigpen, N. N., Gruss, L. F., Garcia, S., Herring, D. R., & Keil, A. (2018). What does the dot-probe task measure? A reverse correlation analysis of electrocortical activity. *Psychophysiology*, *55*(6), e13058. https://doi.org/10.1111/psyp.13058

Thombs, B. D., Kwakkenbos, L., Levis, A. W., & Benedetti, A. (2018). Addressing overestimation of the prevalence of depression based on self-report screening questionnaires. *CMAJ*, *190*(2), E44–E49. https://doi.org/10.1503/cmaj.170691

Tiirikainen, K., Haravuori, H., Ranta, K., Kaltiala-Heino, R., & Marttunen, M. (2019). Psychometric properties of the 7-item Generalized Anxiety Disorder Scale (GAD-7) in a large representative sample of Finnish adolescents. *Psychiatry Research*, *272*, 30–35. https://doi.org/10.1016/j.psychres.2018.12.004

Tomaszczyk, J. C., & Fernandes, M. A. (2014). Age-related differences in attentional bias for emotional faces. *Neuropsychology, Development, and Cognition. Section B, Aging, Neuropsychology and Cognition*, *21*(5), 544–559. https://doi.org/10.1080/13825585.2013.838201

Valliappan, N., Dai, N., Steinberg, E., He, J., Rogers, K., Ramachandran, V., Xu, P., Shojaeizadeh, M., Guo, L., Kohlhoff, K., & Navalpakkam, V. (2020). Accelerating eye movement research via accurate and affordable smartphone eye tracking. *Nature Communications*, *11*(1), Article 1. https://doi.org/10.1038/s41467-020-18360-5

Veerapa, E., Grandgenevre, P., El Fayoumi, M., Vinnac, B., Haelewyn, O., Szaffarczyk, S., Vaiva, G., & D'Hondt, F. (2020). Attentional bias towards negative stimuli in healthy individuals and the effects of trait anxiety. *Scientific Reports*, *10*(1), Article 1. https://doi.org/10.1038/s41598-020-68490-5

Walter, H. J., Bukstein, O. G., Abright, A. R., Keable, H., Ramtekkar, U., Ripperger-Suhler, J., & Rockhill, C. (2020). Clinical practice guideline for the assessment and treatment of children and adolescents with anxiety disorders. *Journal of the American Academy of Child & Adolescent Psychiatry*, *59*(10), 1107–1124. https://doi.org/10.1016/j.jaac.2020.05.005

Wang, Q., Hay, M., Clarke, D., & Menahem, S. (2014). Associations between knowledge of disease, depression and anxiety, social support, sense of coherence and optimism with health-related quality of life in an ambulatory sample of adolescents with heart disease. *Cardiology in the Young*, *24*(1), 126–133. https://doi.org/10.1017/S1047951113000012

Wang, Z., Whiteside, S. P. H., Sim, L., Farah, W., Morrow, A. S., Alsawas, M., Barrionuevo, P., Tello, M., Asi, N., Beuschel, B., Daraz, L., Almasri, J., Zaiem, F., Larrea-Mantilla, L., Ponce, O. J., LeBlanc, A., Prokop, L. J., & Murad, M. H. (2017). Comparative effectiveness and safety of cognitive behavioral therapy and pharmacotherapy for childhood anxiety disorders: A systematic review and meta-analysis. *JAMA Pediatrics*, *171*(11), 1049–1056. https://doi.org/10.1001/jamapediatrics.2017.3036

Waters, A. M., Henry, J., Mogg, K., Bradley, B. P., & Pine, D. S. (2010). Attentional bias towards angry faces in childhood anxiety disorders. *Journal of Behavior Therapy and Experimental Psychiatry*, *41*(2), 158–164. https://doi.org/10.1016/j.jbtep.2009.12.001

Weeks, J. W., Howell, A. N., Srivastav, A., & Goldin, P. R. (2019). "Fear guides the eyes of the beholder": Assessing gaze avoidance in social anxiety disorder via covert eye tracking of dynamic social stimuli. *Journal of Anxiety Disorders*, *65*, 56–63. https://doi.org/10.1016/j.janxdis.2019.05.005

Wehry, A. M., Beesdo-Baum, K., Hennelly, M. M., Connolly, S. D., & Strawn, J. R. (2015). Assessment and treatment of anxiety disorders in children and adolescents. *Current Psychiatry Reports*, *17*(7), 52. https://doi.org/10.1007/s11920-015-0591-z

White, L. K., Helfinstein, S. M., Reeb-Sutherland, B. C., Degnan, K. A., & Fox, N. A. (2009). Role of attention in the regulation of fear and anxiety. *Developmental Neuroscience*, *31*(4), 309–317. https://doi.org/10.1159/000216542

Whiteside, S. P. H., Sim, L. A., Morrow, A. S., Farah, W. H., Hilliker, D. R., Murad, M. H., & Wang, Z. (2020). A Meta-analysis to guide the enhancement of CBT for childhood anxiety: Exposure over anxiety aanagement. *Clinical Child and Family Psychology Review*, *23*(1), 102–121. https://doi.org/10.1007/s10567-019-00303-2

Wieser, M. J., Pauli, P., Weyers, P., Alpers, G. W., & Mühlberger, A. (2009). Fear of negative evaluation and the hypervigilance-avoidance hypothesis: An eye-tracking study. *Journal of Neural Transmission*, *116*(6), 717–723. https://doi.org/10.1007/s00702-008-0101-0

Williams, J. M. G., Mathews, A., & MacLeod, C. (1996). The emotional Stroop task and psychopathology. *Psychological Bulletin*, *120*, 3–24. https://doi.org/10.1037/0033-2909.120.1.3

Wong, H. S., & Edwards, P. (2013). Nature or nurture: A systematic review of the effect of socio-economic status on the developmental and cognitive outcomes of children born preterm. *Maternal and Child Health Journal*, *17*(9), 1689–1700. https://doi.org/10.1007/s10995-012-1183-8

Woody, M. L., Rosen, D., Allen, K. B., Price, R. B., Hutchinson, E., Amole, M. C., & Silk, J. S. (2019). Looking for the negative: Depressive symptoms in adolescent girls are associated with sustained attention to a potentially critical judge during in vivo social evaluation. *Journal of Experimental Child Psychology*, *179*, 90–102. https://doi.org/10.1016/j.jecp.2018.10.011

World Health Organization. (2021). *Mental health of adolescents*. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health

World Health Organization. (2022a). *Mental disorders*. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/mental-disorders

World Health Organization. (2022b). *Mental Health and COVID-19: Early evidence of the pandemic's impact: Scientific brief, 2 March 2022*. World Health Organization. https://www.who.int/publications/i/item/WHO-2019-nCoV-Sci_Brief-Mental_health-2022.1

Xu, Y., Schneier, F., Heimberg, R. G., Princisvalle, K., Liebowitz, M. R., Wang, S., & Blanco, C. (2012). Gender differences in social anxiety disorder: Results from the national epidemiologic sample on alcohol and related conditions. *Journal of Anxiety Disorders*, *26*(1), 12–19. https://doi.org/10.1016/j.janxdis.2011.08.006

APPENDIX A SONA RECRUITMENT INFORMATION

Study Information

Study Name	Attention bias and social skills in youth with anxiety
Study Type	Standard (lab) study This is a standard lab study. To participate, sign up, and go to the specified location at the chosen time.
Study Status	Visible to participants : Approved Active study : Appears on list of available studies
Duration	180 minutes
Points	3 Points
Abstract	The proposed research study will investigate negative attention biases in youth with anxiety using a multi-faceted approach. Questionnaires, eye-tracking data, and mobile sensing data will be collected and analyzed.
Description	In order to investigate the relationship between attention bias, feelings of social inadequacies, and changes in social behaviour, 90 female youth, aged 15-24 diagnosed with and without anxiety disorders will be tested. Participants will complete a questionnaire regarding their experiences in social settings, their social skills, their anxiety symptoms, along with demographic questions. Eye-tracking software will next be employed to assess attention biases in 3 social settings, which includes, 1) static photos (happy, angry, and neutral human faces), 2) dynamic videos depicting social situations with positive, negative, and neutral stimuli, and 3) social media posts with positive, negative and neutral content. Lastly, their daily social life, such as the number of phone calls made, communication and social media apps used, will be objectively and passively recorded for two-weeks using our mobile sensing app. As such, participants will be asked to download the app for two weeks. Every three days, participants will be asked how many individuals they interacted with that day. Participants will not have the option to be an observer for this study, the eye-tracking will take part in the IWK. As the IWK is under high COVID-19 restrictions, we can't allow more people into the IWK than absolutely necessary for our research. Thus, only those who are allowing us to use their data will be included in the study.
Eligibility Requirements	Inclusion criteria: 1) female, 2) aged 15-24, 3) own a smartphone with IOS or Android operating systems, 4) not currently in in-patient care, and 5) do not have a severe visual impairment.
Preparation	Participants will need access to the internet, a smartphone, as well as be able to attend an in-person study visit at the IWK.

APPENDIX B SOCIAL MEDIA ADVERTISMENTS

APPENDIX C LINK TO VIDEO STIMULI

https://dalu-my.sharepoint.com/:f:/r/personal/hl454463_dal_ca/Documents/HBurns%20Stimuli/Videos/clips?csf=1&web=1&e=REVxzV