Psychology Research, December 2020, Vol. 10, No. 12, 465-479
doi:10.17265/2159-5542/2020.12.001

Attentional Bias in Anxious Youth: Clinical Applications

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Over the past decade, the clinical applications of cognitive psychology and neuropsychology methods have increased in popularity, permeating the clinical, education, and public health sectors. At the federal level, NIMH and the Institute of Education Sciences are regarding clinical-translation research as a top priority area for empirical investigation, and several national organizations including APA, the National Academy of Neuropsychology, the Society for Neuroscience, and the Neurocognitive Therapies/Translational Research Special Interest Group are recognizing the important influence of neuroscience and neuropsychology in understanding clinical pathology and guiding intervention plans. This line of inquiry has opened significant avenues for research and innovation in clinical practice, and the study of attentional bias in the etiology, assessment, and treatment of anxiety disorders is one of these important avenues. In recent years, researchers have extended early findings about the neurocognitive processes underpinning threat bias to enhance our understanding of risk factors and mechanisms of anxiety disorders, and inform the development of novel applications for clinical assessment and intervention. However, studies exploring these practical applications of attentional bias and dot probe methodology with anxious children and adolescents lag far behind. The following chapter will briefly review the literature on the clinical implications and direct clinical utility of cognitive psychology methods for measuring attentional threat bias in anxious youth. Applications for enhancing clinical assessment and intervention will be reviewed and discussed. Ultimately, advancing our knowledge of brain-behavior relationships, cognitive mechanisms of therapeutic change, and the efficacy of novel neurocognitive interventions may contribute to a better understanding of emotional and behavior disorders in children and the development of targeted interventions that result in greater treatment efficacy.

Keywords: youth anxiety, attentional bias, neurocognitive therapies, neuropsychology, clinical psychology, clinical neuroscience

Youth Anxiety

Anxiety is a multidimensional construct featuring symptoms of cognitive (e.g., excessive/uncontrollable worry, negative interpretation bias/cognitive distortions, attentional bias toward perceived threat), physiological (e.g., rapid heart beat, shortness of breath, muscle tension), and behavioral (e.g., avoidance) distress (Beck & Clark, 1988; Beck, Emery, & Greenberg, 1985; Lang, 1977; Roblek & Piacentini, 2005; Kendall, Aschenbrand, & Hudson, 2003; Weissman, Antinoro, & Chu, 2008, Weissman et al., 2012). Recent epidemiological reviews have identified anxiety as among the most prevalent childhood psychiatric problems, estimated to affect between 6% and 20% of school-aged youth (Costello et al., 1996; Costello, Egger, & Angold, 2005). These

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same reports have emphasized the persistence of anxiety and related symptoms into adulthood and overall poor prognosis if left untreated. Anxious youth may experience difficulties in social (e.g., limited or unrewarding social networks), familial (e.g., sibling/parental conflict, accommodation around anxiety), and academic arenas (e.g., poor academic performance, school refusal/dropout, limited extracurricular activities), and may experience higher rates of mood and behavioral disorders, drug and alcohol abuse, suicidal behavior, and early parenthood relative to their non-anxious peers (Angold, Costello, & Erkanli, 1999; Kendall et al., 2003; Van Ameringen, Mancini, & Farvolden, 2003; Weissman et al., 2008; Woodward & Fergusson, 2001).

Attentional Bias in Anxious Youth

Attentional Bias to Threat

In everyday life, there are infinite environmental demands for attention that are in direct conflict with independent purposeful goals (Sturm & Chang, 2015). The ability to attend to important environmental cues—including the rapid detection of threat—and ignore information irrelevant to goals is an important skill that is impaired in a range of psychopathology including anxiety disorders (Sturm & Chang, 2015; LeDoux, 2000). Cognitive models of anxiety posit that attentional biases in processing threat-related information may have a prominent role in the etiology and maintenance of anxiety disorders (Beck, Emery, & Greenberg, 1985; Lonigan, Vasey, Phillips, & Hazen, 2004; Mathews & MacLeod, 1985; Mathews & MacLeod, 2002; Mogg & Bradley, 1998). Beck and colleagues (1985) posited that anxiety is associated with a bias in the initial stimulus registration phase of cognitive processing, thereby precipitating the rapid and automatic allocation of attention toward emotionally negative or threat-relevant stimuli, when such stimuli compete with other information for attentional resources. This selective attention bias is thought to initiate, maintain, and even intensify problematic anxiety reactions by inducing a state of hypervigilance. Anxious children who magnify or bias attention toward threatening information in their environment may have greater difficulty disengaging threat and engaging safety, or more simply stated, greater difficulty coping and withstanding a stressful situation. Of equal importance, this threat-based attentional bias may compromise a child's ability to allocate and sustain attention toward activities that may be adaptive for academic and social development, such as taking a test, paying attention in class, or talking to peers (Weissman et al., 2012).

Attentional Bias and Information Processing in Anxious Youth

Information processing theory of anxiety is centered on the idea that interpretation of internal or external stimuli is negatively biased resulting in distorted perception and interpretation of personal experiences. Dysfunctional beliefs may persist over time and develop into cognitive schemas, which can be defined as a cognitive framework or concept that helps organize and interpret information (Beck, Emery, & Greenberg, 2005).

Theoretical models of threat bias suggest that it is not unitary construct but may be comprised of subcomponents including facilitated attention to threat (i.e., early attention orienting), difficulty disengaging attention away from threat (the degree to which a threat stimulus captures attention and impairs attention switching to another stimulus), and attention avoidance of threat. Both difficulty in threat disengagement and attention avoidance of threat have been shown to be present at late (more conscious, strategic) stages of processing of attention bias (e.g., memory and interpretation) although difficulty in disengagement may occur during both early (automatic) stages (e.g., attention and encoding) and later (strategic) stages of information

processing (Bar-Haim et al., 2007; Cisler & Koster, 2010).

Research suggests that in anxiety disorders, attention bias towards threat is causally and reciprocally linked to emotion-based misperceptions of environmental threat and/or social evaluation, aversive imagery, negative self-talk (e.g., "they don't like me"), negative interpretation bias (e.g., "why are they looking at me? I must have done something embarrassing"), and may ultimately result in entrenched cognitive schemas focused on maladaptive beliefs (e.g., "I am not likeable", "The world is an unsafe place"; Beck et al., 1985; Kendall, 2000; Mogg & Bradley, 1998; Puliafico & Kendall, 2006). Together, these symptoms and processes contribute to the cognitive (e.g., worry), physiological (e.g., arousal), and behavioral (e.g., avoidance) distress unique to the pathology, function, and expression of youth anxiety (Derryberry & Reed, 2002; Puliafico & Kendall, 2006). For example, a child with social phobia who preferentially attends to what is perceived as negative social cues and interpretations may ultimately engage in systematic avoidance of various social situations (e.g., activities with peers, public performances etc.), which leads to maintenance of the initial fears (belief that social actions will result in rejection, criticism etc.) given no disconfirming evidence. These beliefs often concern impending danger at every stage of information processing including perception, interpretation, and recall (Beck & Clark, 1997). The maladaptive beliefs are automatic, or effortless, rapid, and require little awareness (Logan, Schachar, & Tannock, 1997). Although information processing theory has slightly different applications for each disorder, the general preoccupation with and misinterpretation of threatening information is central to generalized anxiety disorder, social anxiety disorder, separation anxiety, and obsessive-compulsive disorder.

Neurobiological Basis of Attentional Bias

With regard to the neurobiological underpinnings of attention bias, processing biases to threat have their roots in dedicated brain circuitry and the control or the responsiveness of this circuitry is posited to differ in anxious and non-anxious people (Mogg & Bradley, 1998). The underlying neural basis of threat bias in anxiety involves both the amygdala and the vPFC. The amygdala, the emotional processing center of the brain, is characterized by enhanced sensitivity to threat, driving a bottom-up process of anxiety generation. The vPFC's role in part is to modulate emotional responding fails to adequately engage in top-down regulatory processes to counteract amygdala hypersensitivity. The result is an automatic, often unconscious, attentional bias to threat, which subsequently fuels anxious cognitions and behaviors (Bishop, 2008). Adolescents with GAD have shown greater amygdala, vPFC, and ACC activation relative to controls when viewing fearful versus happy faces. Significant positive correlation between the top-down (vPFC and ACC) and bottom-up (amygdala) regions using functional connectivity analyses supported the proposed fear circuitry between the PFC and amygdala (McClure, Ericson, Laibson, Loewenstein, & Cohen, 2007).

Attentional Bias Studies

Attentional bias to threat has been observed across a wide range of anxiety disorders as well as in high trait anxious individuals using different methodologies including visual dot-probe, emotional Stroop, emotional n-back, and dichotic listening tasks (Bar-Haim et al., 2007; Sturm & Chang, 2015; Waters, Shallcross, & Fivush, 2013). The adult literature supports an attentional bias toward threat in Generalized Anxiety Disorder (GAD) (Bradley, Mogg, White, Groom, & de Bono, 1999; Mogg & Bradley, 2005), Social Phobia (SP) (Mogg, Philippot, & Bradley, 2004), Post-Traumatic Stress Disorder (PTSD) (McNally, Kaspi, Riemann, & Zeitlin,

1990), Obsessive-Compulsive Disorder (OCD) (Tata, Leibowitz, Prunty, Cameron, & Pickering, 1996), and Panic Disorder (PD) (McNally, Riemann, & Kim, 1990; McNally, Amir, Louro, Lukach, Riemann, & Calamari, 1994). This selective processing bias typically occurs with brief stimulus presentations, supporting its automaticity and its manifestation at the early stages of information processing (Mogg, Bradley, Miles, & Dixon, 2004; Mogg & Bradley, 1999).

By and large, child studies have provided similar evidence as adult studies in that clinically anxious and high trait anxious children as young as 6-7 years of age disproportionately direct attention to threat stimuli compared to non-clinical controls (e.g., Heim-Dreger, Kohlmann, Eschenbeck, & Burkhardt, 2006; Monk et al., 2006; Roy et al., 2008; Waters et al., 2008; Waters, Mogg, Bradley, & Pine, 2008; Griffith et al., 2010; in press). However, the research on threat-based attentional bias in anxious youth is limited and mixed. Several studies have demonstrated biases toward threat cues using visual probe tasks, which require participants to respond to neutral target probes that follow both threatening and neutral stimuli. Faster reaction times to probes replacing threat stimuli relative to neutral stimuli indicate a threat-related attentional bias. Vasey and colleagues (1995) reported a significant attention bias toward emotionally threatening words in the lower probe position, only, in anxious youth relative to healthy controls, partially supporting an attentional bias toward threat-related stimuli (Vasey, Daleiden, Williams, & Brown, 1995). In a similar vein, Vasey, El-Hag, and Daleiden (1996) reported a significant attentional bias toward threat cues (combined physical and social threat), relative to neutral words, in high-test-anxious youth. Additional analyses revealed a significant bias away from threat words in the low-test-anxious children, although this effect was mediated by gender and only occurred in low-test-anxious males. Taghavi and colleagues (1999) reported an emotion-specific attention bias toward threat-related, but not depression-related words in GAD children, relative to neutral stimuli, suggesting that GAD youth may feature an affect-congruent bias toward threat-relevant but not depression-related words. The mixed anxiety-depression group included in this study did not show any attentional bias toward threat or depression cues.

Finally, Dalgleish and colleagues (2003) combined and analyzed data from previous studies in an attempt to compare the utility of emotional Stroop and dot probe tasks in detecting attentional bias in anxious youth. Children and adolescents (7-18 years) diagnosed with GAD (n = 24), PTSD (n = 24), depression or dysthymia (n = 19), and a non-clinical control group (n = 26) were administered a verbal dot-probe task (Taghavi et al., 1999), an emotional Stroop paradigm, and a word memory task, both featuring 12 threat-related (e.g., horror), 12 trauma-related (e.g., accident), 12 depression-related (e.g., hopeless), 12 happy (e.g., pleasant), and 12 neutral (i.e., animal) words. The GAD group demonstrated a content-specific attentional bias toward threat-related material on the dot probe paradigm, whereas the PTSD, depressed, and control groups did not. Interestingly, the PTSD group showed an attentional bias away from (i.e., avoidance of) depression-related words, indicating unique information processing of depressive material in this anxious subgroup. Although inconsistent with previous findings, no significant effects were reported in this study on the emotional Stroop task.

Research examining emotion-based attention bias in anxious youth using visual dot probe paradigms with pictorial and facial stimuli has been even less consistent. Waters, Lipp, and Spence (2004) compared attentional bias in 23 anxious and 23 non-anxious children (9-12 years) using a pictorial dot probe task featuring threat-related (e.g., snakes, spiders, sharks, aimed guns, abduction scenes), pleasant (e.g., puppies, kittens, ice cream, smiling faces), and neutral (i.e., household items and appliances) pictures as the target stimuli. Although

both groups displayed an attentional bias toward threatening pictures, the inter-group difference in bias scores was not significant. Hence, the authors concluded that selective attention to threat may be common to all children, not just those with clinical-level anxiety disorders.

Pine and colleagues (2005) compared 34 PTSD youth (i.e., severe maltreatment) and 21 healthy controls (7-13 years) in performance on a facial dot probe task comprising happy, angry, and neutral faces (Pine et al., 2005). Contrary to the initial hypothesis, results showed that PTSD youth exhibited an attentional bias away from angry faces, which was associated with severity of physical abuse, whereas controls did not. Prior studies have suggested that PTSD youth may feature distinct attentional processes relative to other youth anxiety groups, and may, in fact, demonstrate unique attentional biases away from emotion-based stimuli (Dalgleish et al., 2003; Dalgleish et al., 2001). In a similar vein, Monk and colleagues (2006) compared 18 adolescents (9-17 years) with GAD and 15 matched non-clinical controls in performance on a facial dot probe task featuring angry and neutral faces (Pine et al., 2005), while undergoing event-related functional magnetic resonance imaging (fMRI) (Monk et al., 2006). Consistent with Pine and colleagues (2005), GAD youth demonstrated a greater attentional bias away from angry faces, as well as greater right ventrolateral prefrontal cortex activation in response to the threatening facial stimuli. In addition, as ventrolateral PFC activation increased in the GAD group, anxiety symptom severity diminished, suggesting that this activation may serve as a compensatory response in GAD youth. The link between youth anxiety, threat bias, and right ventrolateral PFC activation has received support elsewhere in the literature (e.g., Telzer et al., 2008).

In contrast to these findings, recent facial dot probe studies support an attentional bias toward threat cues in anxious youth. Waters and colleagues (2008) administered the same visual probe paradigm used by Pine and colleagues to 23 GAD children and 25 non-anxious controls (9-12 years) in a standard research setting (i.e., not under fMRI conditions). No threat bias was found in GAD youth or healthy controls. However, when the GAD group was divided by parent-reported anxiety severity, severely anxious children with GAD demonstrated a significant attention bias toward both angry and happy faces, whereas low-level GAD youth and non-clinical controls showed no attention bias for emotional faces. Moreover, within the GAD group, attentional bias toward angry faces was associated with the presence of comorbid social phobia, and increased parent-reported anxiety symptom severity, as measured by the Spence Children's Anxiety Scale (Spence, 1998). In a similar vein, Roy and colleagues (2008) compared 101 youth with GAD, social phobia, and/or separation anxiety (7-18 years) enrolled in a multi-site anxiety treatment study (Child Anxiety Multi-Modal Treatment Study (CAMS), e.g., Walkup et al., 2008) and 51 non-anxious youth recruited separately (9-18 years), in performance on the same visual probe task (e.g., Pine et al., 2005). Consistent with Waters et al. (2008), anxious participants demonstrated a greater attentional bias toward the threatening facial stimuli relative to healthy controls. Of note, threat bias in the anxious group did not vary significantly across anxiety disorders, and there were no group differences in attention in response to happy faces.

In summary, while adult studies have reported a consistent link between anxiety and attentional bias toward threat, similar associations have been documented in anxious youth, albeit with greater inconsistency. Differences in these childhood findings may be due to small sample sizes, variable testing conditions (e.g., fMRI), variations in methodology, clinical vs. non-clinical populations, and potentially distinct attentional processes across different disorders (e.g., PTSD) and/or stages of development. A subset of the research reviewed also suggests that stimulus type (i.e., words vs. pictures) may influence a measure's perceived threat level, and subsequent sensitivity to detect inter-group differences (e.g., Taghavi et al., 1999, Waters et al.,

2004). Puliafico and Kendall (2006) hypothesized that pictorial stimuli may be more "objectively threatening" than words, enough so that both anxious and non-anxious children selectively attend to them, minimizing inter-group effects. This theory aligns well with the cognitive-inhibition (CI) hypothesis put forth by Kindt and colleagues (1997), which posits that all young children selectively attend to threat in their environments, but as they undergo cognitive maturation (e.g., executive skills development), low-anxious youth learn to inhibit this attentional bias, while high fear levels prevent clinically anxious children from doing the same.

Attentional Bias in Clinical Assessment

One hallmark study to date has examined attentional bias as a clinical tool to enhance clinical assessment and differential diagnosis in anxious youth. Specifically, Weissman et al. (2012) examined attentional bias as a clinical assessment tool to help differentiate attention problems in anxious vs. ADHD youth (Weissman et al., 2012). It can be challenging to distinguish between anxiety and ADHD, especially in young children, as both disorders may feature attention problems, difficulty concentrating in class, and elevated motor activity. Of the anxiety disorders, ADHD is most closely related to the neurophysiological symptoms of generalized anxiety disorder (GAD), including irritability, restlessness, and concentration difficulties. The major difference between the disorders is that anxious youth demonstrate these symptoms due to excessive and uncontrollable worry (American Psychiatric Association, 2013) and threat-related attentional biases (e.g., Weissman et al., 2012), rather than hyperactivity and deficits in selective and sustained attention and inhibitory control associated with ADHD (Pliszka, Browne, Olvera, & Wynne, 2000). Consistent with this position, Weissman et al. (2012) found that children with ADHD performed more poorly on neurocognitive tasks of general attention processes (i.e., selective, sustained, and shifting attention) on the Stroop Color Word Test and the Conners' Continuous Performance Test, two classic measures commonly used in the assessment of ADHD, relative to their anxious counterparts, who exhibited greater attentional biases toward threatening facial cues on an adapted Faces Dot Probe Task (Weissman, 2011b). These findings lay the groundwork for the theory that distinct mechanisms or biomarkers of inattention may underlie anxiety and ADHD in youth, and suggest that interventions should be differentially designed and implemented to target these distinct attention mechanisms (e.g., using executive training with ADHD children vs. attentional bias modification with anxious youth).

Treatment Implications and ABM

Although many children benefit greatly from standard treatments of cognitive behavioral therapy (CBT) and pharmacotherapy, a sizable proportion of youth (20-35%) either do not improve or derive only partial benefit, emphasizing the need for broader treatment options (Walkup et al., 2008; Rynn et al., 2011). The centrality of attentional threat bias in the etiology and maintenance of anxious youth implicates the significance of actively assessing threat bias early on in treatment and investigating novel treatments that may target attentional bias as an active mechanism of therapeutic change.

Attentional Bias Modification

Current cognitive theories of anxiety suggest that attentional bias to threat cues may be malleable and amenable to treatment and a growing body of research supports attention bias modification (ABM) training as a novel treatment approach for youth with anxiety. ABM is a novel theory-driven treatment derived from established experimental data on threat-related attention biases in anxiety (Bar-Haim et al., 2007) and utilizes computer-based attention training protocols to directly target and implicitly modify biased attention patterns in

anxiety-disordered individuals. Most studies investigating the effect of ABM on anxiety disorders have used a variation of the now classic probe detection task (MacLeod, Matthews, & Tata, 1986), which has been modified to create an attention bias either toward or away from threatening cues. In the basic probe detection paradigm, two stimuli, one neutral the other threat-related, are presented simultaneously on a computer screen. The stimuli disappear and one is replaced by a neutral probe (either a letter or symbol), and participants are asked to identify the probe as quickly and accurately as possible. Faster response latency to probes replacing threat versus neutral stimuli is thought to reflect an attention bias toward threat. This paradigm has been modified for use in attention training protocols to systematically increase the proportion of probes appearing at the location of the neutral stimuli, thereby inducing a bias away from threat over a systematic repetition of hundreds of trials. Theoretically, ABM is designed to target and modify the underlying cognitive constructs thought to play a causal role in the pathogenesis and maintenance of anxiety, and has demonstrated initial efficacy as a time- and cost-efficient intervention for anxious adults. Recent studies have successfully trained attention away from threat cues in adults using visual dot probe methodology, and have shown initial promise in reducing state and trait anxiety symptom severity and threat-based attentional bias in GAD (Amir et al., 2009), socially anxious (Schmidt et al., 2009), and non-clinical adults (See et al., 2009). A recent meta-analysis of adult ABM treatment outcomes (Hakamata et al., 2010) from 10 published randomized controlled trials reported that ABM produced a significant medium effect for anxiety ($d = 0.61$). Moreover, when studies were limited to clinically diagnosed samples (three studies), the effect size was medium to large and comparable to those observed for CBT and SSRIs ($d = 0.78$), suggesting that ABM is a promising new intervention for anxiety management in adults. Despite promising early data, ABM protocols have not been widely tested with patients with clinical-level anxiety disorders, with only a handful of studies thus far published in clinical adult populations with GAD (Amir, Beard, Burns, & Bomyea, 2009) and Social Anxiety Disorder (Amir et al., 2009; Schmidt, Richey, Buckner, & Timpano, 2009). Nonetheless, the adult CBM findings provide initial evidence that selective processing of threat cues may, in fact, be malleable and amenable to treatment, and further suggest that attentional selectivity may not only play a causal role in anxiety pathology, but may also serve as an important mechanism of therapeutic change. The comparable effect sizes of CBM and traditional anxiolytic treatments (e.g., CBT and/or pharmacotherapy; e.g., Clark, et al., 2003; Gelenberg et al., 2000; Gould, Safren, Washington, & Otto, 2004) suggest the potential utility, and plausible downward extension, of attention training procedures in mitigating both clinical and cognitive symptoms in anxious youth.

Although child work in the area is particularly scant, a growing number of studies indicate positive findings. A small open ABM trial with clinically anxious youth recently showed positive results (Rozenman, Weersing, & Amir, 2011) along with a randomized controlled trial (RCT) in anxious youth indicating decreased threat bias after training was related to reduced vulnerability to stress (Bar-Haim et al., 2011). A more recent RCT suggested that ABM compared to two control conditions reduced pediatric anxiety symptoms and severity in clinically diagnosed youth (Eldar et al., 2012).

Considered together, these early findings illustrate how the translation of basic psychopathology research may prove useful in developing new treatment approaches, and how visual probe methodology may further elucidate the unique attentional processes underlying anxiety vulnerability and pathogenesis (Schmidt et al., 2009). From a mechanism perspective, it is not entirely clear which attention component is being trained with existing ABM protocols; that is whether facilitated attention to or difficulty disengaging from threat stimuli is most implicated in ABM. However, one recent evoked potential study revealed that attention training away

from threat modulated anxious adults' top-down processes of attention control rather than early attention orienting processes (Eldar & Bar-Haim, 2010). Moreover, evidence supports the idea that threat bias in anxiety may rely to a larger degree on more top-down and elaborative/strategic processing of threat than on automatic pre-attentive processes (Bar-Haim et al., 2007; McNally, 1995). In one of the few imaging study to examine the effects of ABM, lateral frontal regions in healthy adults were altered by attention training towards and away from threat (Browning et al., 2010). Accordingly, higher-order attention control ability appears to play a role in the degree to which an individual can disengage attention from threat, serving as a possible predictor of treatment response and potentially modifiable by ABM.

Future Directions

The ABM literature reviewed suggests that the translation of basic psychopathology research may prove useful in the clinical assessment of childhood psychopathology and in the development of new anxiety treatments, and moreover, that these methods may further elucidate the unique attentional processes underlying anxiety vulnerability and pathogenesis (Schmidt et al., 2009). Considered together, findings from the ABM studies reviewed provide initial evidence that attention bias modification may be effective in (a) reducing selective attentional processing of threat and (b) mitigating associated real-world anxiety vulnerability and state, trait, and clinical anxiety symptom severity. Further, these data indicate that attentional selectivity may not only play a causal role in the pathogenesis of anxiety, but may also serve as an important mechanism of therapeutic change.

Research based on translational neuroscience has also opened avenues for the integration of novel interventions such as ABM with standard treatments such as CBT and pharmacotherapy. Increasingly, translations from basic experimental psychology and cognitive neuroscience are yielding innovative approaches to treatment focused on cognitive remediation or training in a variety of psychiatric disorders including schizophrenia, dyslexia, attention deficit hyperactivity disorder as well as anxiety (Fisher, Holland, Merzenich, & Vinogradov, 2009; Gabrieli, 2009; Hale et al., 2013; Klingberg, 2006; Weissman, Lichtin, & Danzig, 2015; Weissman, 2011a). Continuing research into the efficacy and mechanisms underlying ABM should help to elucidate whether it is best utilized as an independent or augmentative treatment for pediatric anxiety disorders. Moreover, exploring potential mechanisms such as baseline threat bias as well as higher-order attention control capacities will serve to clarify etiology, predictors of treatment response and ultimately refine available treatments.

A broad neurocognitive perspective to the clinical study of pediatric anxiety is valuable. Within this perspective, information from varied domains of investigation including genetics, neuroimaging and neuropsychology can be integrated into a translational framework that can inform our understanding of not only phenomenology but predictors of treatment response as well as novel interventions. Ultimately, advancing our knowledge of brain-behavior relationships, cognitive mechanisms of therapeutic change, and the efficacy of novel neurocognitive interventions—like attentional bias modification—will contribute to a better understanding of emotional and behavior disorders in children, and more pragmatically, a better understanding of how to treat these problems. Indeed, developing a more accurate and integrated picture of children's clinical and neurocognitive functioning may ultimately translate into better identification of childhood disorders and development of targeted interventions that result in greater treatment efficacy.

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