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Disordered Attention: Implications for Understanding and Treating Internalizing and Externalizing Disorders in Childhood

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Abstract

In this article, we present evidence that disorders of attention are present in wide range of psychological disorders, and that the appropriate assessment and treatment of these attention difficulties can be an important adjunct to traditional therapeutic approaches. We review approaches to attention training in some detail and discuss how attention-focused treatment might be implemented in clinical practice.

Our Transdiagnostic Approach

The power of a transdiagnostic approach is that it allows multiple forms of psychopathology to be understood and treated within a unified theoretical framework. Inherent in this approach is a focus on common mechanisms that underlie the development and maintenance of psychological disorders, as opposed to factors that are unique to particular clinical presentations. Our view of transdiagnostic approaches assumes that there are common risk factors that transcend diagnostic categories, and that the phenotypic expression of any risk factor depends upon interactions with any number of other risk and protective factors within the individual, their family, and their environment. Treatments that focus on important transdiagnostic risk factors have the potential to alter these cascading interactions and improve outcomes across a range of clinical disorders.

The assessment and treatment of transdiagnostic risk factors can be especially beneficial in young populations, where comorbidity is the rule and many DSM-IV disorders have not yet reached their full clinical manifestation. As developmental psychopathologists, we approach most risk and protective factors from a transdiagnostic perspective. We consider variables at the individual level (e.g., cognitive processes, temperament, social skills), family level (e.g., parenting, parent stress, parent psychopathology), and environmental level (e.g., neighborhoods, schools, peer environments) as potential risk or protective factors for a wide range of adverse outcomes. While much of our work has focused on externalizing disorders, we believe that many of the mechanisms involved in the etiology and maintenance of externalizing disorders are relevant to other forms of psychopathology.

The high comorbidity of psychological disorders among children and adolescents underscores the importance of developing transdiagnostic treatments. Comorbidity is common within the broad domains of internalizing disorders (i.e., forms of emotional distress such as anxiety, fear, and depression) and externalizing disorders (i.e., behavior problems such as defiance, aggression, hyperactivity, and delinquency). Comorbidity is also quite common across the two domains, particularly in childhood and adolescence (see

Angold, Costello, & Erkanli, 1999). Unfortunately, children with comorbid internalizing and externalizing disorders often have more severe courses of illness and are at higher risk for negative outcomes such as school failure and relationship difficulties (e.g., Capaldi, 1992; Dishion, 2000). The correlation between internalizing and externalizing disorders suggests that there may be common intervention strategies that would treat or prevent both emotional distress and disruptive behaviors.

Our work has identified several promising transdiagnostic mechanisms that contribute to the etiology and/or maintenance of child and adolescent psychopathologies. We have written elsewhere, for example, about the power of self-regulation as a protective factor for both internalizing and externalizing disorders in youth (Dishion & Connell, 2006). In this paper, we focus on attentional dysfunction as a transdiagnostic framework for understanding, preventing, and treating psychopathology across internalizing and externalizing problem behaviors in youth.

Attention as a Multifaceted Process

Before reviewing evidence for attention as a transdiagnostic mechanism, we provide a working definition of attention and consider its relationship to adaptive behavior. Broadly, attention is defined as the set of processes that allow us to process certain information to the (relative) exclusion of other information. Given the great complexity of information available to our senses at any given time, attention is crucial for sorting out relevant information and limiting the amount of information that gains access to further processing. Attention can be “pulled” in a largely involuntary manner, such as when we hear our name or a loud noise. Attention can also be “pushed” in a more goal-directed or voluntary manner, as when we scan a crowd for a friend’s face, or when we focus on reading a book despite background noise from the television or radio. Adaptive behavior depends upon a delicate balance between these forces: Attention must be focused strongly enough so as to resist distraction from irrelevant thoughts and sensations, yet attention must be pliable enough to be reoriented in the face of important information, even if that information occurs outside of the attentional focus (e.g., a car honking when you are focused on a conversation). An attention system that fails to achieve an adaptive balance between voluntary and involuntary attention may place an individual at risk for maladaptive behavior.

Attention can be divided into a handful of subsystems. Different researchers have taken different approaches to parsing attention, but most attention models share similar features. One influential model of attention is Posner and colleagues’ attention network model (e.g., Berger & Posner, 2000). Posner’s attention model is informed by neurobiological studies and distinguishes three partially separable attention systems: alerting, orienting, and executive attention. The alerting system is involved in achieving and maintaining an alert state. It is involved in both tonic (trait-like) and phasic (state-like) preparedness to respond, and its sensitivity may vary both within and across individuals. For example, an individual may show dampened alertness when drowsy and heightened alertness when alone in a dark alley. Further, different individuals may differ in how easily (or under what circumstances) they engage and/or maintain an alert state. The alerting system is closely related to vigilance. The alerting system relies on noradrenergic (norepinephrine, noradrenaline) neural circuits that originate in a brainstem nucleus known as the locus coeruleus (LC). The LC is the principal site for synthesis of norepinephrine in the brain. LC neurons project widely throughout the brain, but connections between the LC and the parietal cortex, especially the right lateral parietal cortex, appear to be the most strongly involved in alerting (Posner & Petersen, 1990; Posner, Sheese, Odludas, & Tang, 2006).

The orienting system is involved in moving attention to specific locations in space. In the laboratory, attentional orienting is often measured by means of predictive cues: Targets that appear in expected locations are processed more quickly than targets that appear in unexpected locations. Orienting can be further divided into the processes of engaging, moving, and disengaging attention. Poor orienting can cause attention to get “stuck” on information that is no longer relevant (poor disengagement) and can interfere with the ability to identify and focus on relevant information (poor engagement). The orienting network is believed to rely largely on acetylcholine transmission (Posner & Rothbart, 2007) within a distributed brain network that includes areas of the parietal lobe, the temporal-parietal junction, the pulvinar, and the superior colliculus (Corbetta, Kincade, Ollinger, McAvoy, & Shulman, 2000; Posner & Petersen, 1990; Posner et al., 2006).

The executive attention system is needed for top-down or goal-oriented control of attention, especially in situations where attention might otherwise be “pulled” to irrelevant information. For example, executive attention is needed to perform the color-word Stroop task, in which participants are asked to inhibit their natural word-reading response and instead focus on the ink color of words. The executive attention network is brought online to enhance processing of information that is explicitly relevant to current behavior (e.g., consistent with goals or task instructions). Weak executive attention may result in distractibility and poor goal maintenance. The functions of the executive attention system overlap with what have traditionally been referred to as “executive functions.” However, executive functions include a broader domain of skills (e.g., working memory, problem-solving), so executive attention can be viewed as a subset of general executive functioning. Executive attention has been linked to the anterior cingulate cortex and prefrontal areas, and appears to be moderated primarily by dopaminergic transmission (Bush, Luu, & Posner, 2000; Cools, 2008; Granon et al, 2000; MacDonald, Cohen, Stenger, & Carter, 2000).

The coordinated activity of the alerting, orienting, and executive attention networks helps maintain an adaptive balance between voluntary (“push”) and involuntary (“pull”) attention. While the executive attention system is critical for maintaining attention toward goal-relevant information, the alerting and orienting systems are critical for the flexible reorienting of attention when new, potentially relevant information occurs, even if that information is extraneous to the current goal-directed focus of attention. Alerting, orienting, and/or executive attention systems that are either too weak or too strong will impede the balance between voluntary and involuntary attention and are likely to have cascading effects on higher-order cognitive and emotional systems.

It is important to note that the attention processes that are most familiar to parents, teachers, and clinicians (e.g., selective attention, distractibility, divided attention, focused attention) generally involve the coordinated processing of multiple attention systems. Accordingly, attention difficulties that are similar at the behavioral level could arise from deficits in different subcomponents of attention. Closer examination may reveal that particular subcomponents have unique contributions to adaptive behavior and psychopathology, as well as different implications for prevention and intervention.

We make few assumptions about the causes of attention problems in youth at risk for psychopathology. Instead, our primary assumption is that attention dysfunction can be assessed and treated at the individual level, and that improvements in attention will be associated with improvements in functioning and psychological health. We remain open to the possibility that attention dysfunction may arise from different causes (e.g., neurobiological development, temperament, learning history) both within and across diagnostic categories, and that the downstream effects of attention problems will differ depending upon the particular constellation of risk and protective factors at the individual,

family, and community levels. Fig. 1 illustrates our general working model for the role of attention in psychopathology.

As will be discussed below, there is growing evidence of attention dysfunction in both internalizing and externalizing disorders. While attention dysfunction is unlikely to be necessary or sufficient to cause the development of any particular psychological disorder, deficits in attention may increase the risk for a wide range of maladaptive outcomes. Therefore, much is to be gained by assessing, identifying, and treating attention dysfunction, particularly among individuals with poor response to standard clinical interventions.

Assessment of Attention

Ideally, clinical assessments of attention would allow practitioners to identify which subcomponents of attention are disrupted in order to facilitate targeted treatment of those specific systems. Unfortunately, distinctions between subcomponents of attention, such as alerting, orienting, and executive attention, are currently only possible using laboratory measures (e.g., computerized tasks with measures such as reaction time, accuracy, and brain activity). Although these measures are able to distinguish components of attention that are difficult or impossible to assess by observation, they rely on averaging across groups of participants and have not yet been validated or normed for individual-level clinical assessments. We hope that additional clinical measures will soon become available. In the meantime, it is important for clinicians to keep in mind that many aspects of attention may be missed by current clinical assessments, and to remain open to the possibility that these unobserved aspects of attention may be playing an important role in the clinical presentation and/or treatment response of their clients.

Clinical assessments of attention are generally limited to executive attention. Unlike alerting and orienting, aspects of executive attention can be observed and reported by parents and teachers. A notable advantage of questionnaire measures of attention is that they can be administered as a routine part of the initial clinical assessment, thus providing a low-cost and efficient screen for attention difficulties. The Behavior Rating Inventory of Executive Functioning (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000) is one well-validated, age-normed questionnaire that can be used to screen for attention difficulties. The BRIEF is an 86-item parent- and/or teacher-report questionnaire designed to assess executive function in youth ages 5 through 18 years. The BRIEF produces age-normed scores for overall executive functioning (Global Executive Composite; GEC), metacognitive skills (initiation, planning, working memory, organization, self-monitoring), and behavior regulation (inhibition, shifting, emotional control). Although primarily a measure of executive function, the BRIEF also explicitly addresses aspects of attention (e.g., attention span, distractibility, concentration).

Another attention-related questionnaire that may be clinically useful is the Effortful Control (EC) subscale of Rothbart's temperament questionnaire (e.g., Rothbart, Ahadi, Hershey, & Fisher, 2001). The EC scale is conceptually and empirically related to executive attention (e.g., Rothbart, Sheese, & Posner, 2007), and versions of the scale have been developed for ages 3 years to adulthood. One drawback to this measure is that it has not been normed for clinical use. Nevertheless, examination of item responses could help guide clinical decisions, and with frequent administration of the questionnaire as a routine screening instrument, practitioners could begin to identify cut-off scores that suggest attention difficulties.

Greater differentiation of attention skills can be obtained through neuropsychological testing, although the aspects of attention tapped by neuropsychological measures generally involve the coordinated processing of multiple attention systems rather than specific

attention networks. Well-validated, standardized neuropsychological measures are available to assess aspects of attention such as sustained attention, attention switching, and divided attention (e.g., Stroop tasks, continuous performance tasks, target-search tasks; see Ward [2010] for a review). Neuropsychological assessments of attention are very helpful for diagnosing and developing interventions for youth with academic difficulties, but are often too costly and time-intensive to be used as routine screening measures.

Finally, it is important to note that attention dysfunction should not be confused with ADHD (or with scores on ADHD rating scales). Despite the name, ADHD appears to be a disorder of executive function or response inhibition rather than attention per se (Barkley, 1997; Nigg, 2005). Only a handful of studies have found evidence of basic attention impairment in ADHD, and many more have failed to find such differences (see Nigg, 2005, and Wilding, 2005, for reviews). As noted by Barkley, poor response inhibition may create the “appearance of inattention seen in ADHD. [However, this inattention] probably represents an impairment in goal- or task-directed persistence arising from poor inhibition” (Barkley, 1997, p. 84). Of course, just as with other disorders, there are likely to be some individuals with ADHD who also have dysfunction in basic attention systems, but these deficits should not be seen as central to the ADHD syndrome.

Empirical Support for Attention as a Transdiagnostic Mechanism

Studies using questionnaire reports of attention functioning provide considerable evidence for a link between attention and psychopathology (e.g., Berntzen, 1987; Chaves & Barber, 1974; Gross, 1998; Miller, 1987; Mischel & Ebbesen, 1970). Attention skill appears to be helpful in moderating trait anxiety (Derryberry & Reed, 2002), is closely linked to emotion regulation in infants (Harman, Rothbart, & Posner, 1997; Kochanska, Coy, Tjebkes, & Husarek, 1998; Rothbart, Ziaie, & O’Boyle, 1992), and buffers the effect of negative emotionality on problem behaviors in children (see Eisenberg, 2002, for a review).

Association with deviant peers is one of the strongest environmental predictors of antisocial behavior in adolescence (Dishion, Nelson, & Bullock, 2004; Elliott, Huizinga, & Ageton, 1982; Patterson, 1993). In a large longitudinal study, Dishion and colleagues (Dishion & Connell, 2006; Gardner, Dishion, & Connell, 2008) found that composite scores on a measure of executive attention (as rated by parents, teachers, and the adolescent) moderated the effects of deviant peers on the development of problem behavior in adolescence. Deviant peers predicted growth in antisocial behavior from ages 17 to 19, but this effect was moderated by executive attention such that deviant peers strongly predicted growth in antisocial behavior among teens with low executive attention, but did not affect growth in antisocial behavior among teens with high executive attention. Thus, strong executive attention seems to protect youth from the effects of deviant peers, even after controlling for demographic variables and initial levels of antisocial behavior.

Somewhat surprisingly, a similar moderating mechanism was found for the development of depression in this sample of adolescents (Dishion & Connell, 2006). Psychosocial stress was associated with increased risk for depression, but this relationship was moderated by executive attention. Youth with strong executive attention seemed to be buffered from the depressogenic effects of stressful life experiences. These findings provide intriguing support for executive attention as a transdiagnostic protective factor.

Although executive attention can be assessed by questionnaires, other components of attention, such as alerting and orienting, can only be identified using laboratory measures. We recently used an event-related potential (ERP) known as the P1 to examine relationships between the alerting and orienting systems and psychopathology in youth ages 9 to 14 years. The P1 is a positive deflection in the ERP waveform that occurs about 100 ms after a visual

stimulus is presented. The P1 is an automatic sensory response that occurs whenever new visual information appears. However, the P1 is also very sensitive to the allocation of attention. In particular, the magnitude (voltage) of the P1 is amplified if the visual stimulus is being attended, reflecting signal enhancement and preferential processing of the attended stimulus.

We measured the P1 while participants played the computerized Attention Network Task (ANT; Fan et al., 2002). The ANT requires participants to indicate the direction of a central arrow (target) while ignoring arrows on either side of the target (flankers) that may be pointing in the same or the opposite direction. To assess alerting and orienting, the game presents different types of cues before the target appears. On some trials, no cue is presented and the target appears after an unpredictable period of time. On other trials, a warning cue indicates that the target will appear soon, which should activate the attentional alerting system and improve attention to the upcoming target. On the remaining trials, a spatial cue indicates both when and where the target will appear, which should activate both the alerting and orienting systems and allow participants to focus their attention on the precise location of the upcoming target. The efficiency of the alerting and orienting networks was estimated by comparing the P1 response to targets preceded by these different cue types.

We found intriguing differences in the P1 alerting and orienting responses for youth with internalizing versus externalizing symptoms. Youth with higher parent-reported internalizing symptoms on the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001) were more responsive to the predictive spatial cues ($r=.37$, $p<.05$), suggesting an overactive orienting system. A similar relationship existed for parent-reported externalizing symptoms ($r=.31$, $p<.05$), suggesting that increased orienting is broadly related to risk for psychopathology. However, only externalizing scores were associated with sensitivity to the warning cues ($r=-.29$, $p=.6$), suggesting a specific relationship between weak alerting and externalizing symptoms. Finally, the combination of externalizing behaviors and callous-unemotional symptoms showed a particularly strong relationship with weak alerting ($r=-.45$, $p<.001$) (Racer et al, submitted).

These findings are notable for a couple of reasons. First, they provide evidence of meaningful individual differences in basic attention processes such as alerting and orienting. Second, they suggest that there may be dissociable relationships between particular attention processes and particular clinical presentations (e.g., internalizing versus externalizing). It is also notable that we found these effects despite using a nonclinical community sample with relatively mild symptom levels (CBCL Total *T*-scores ranged from 33 to 72). It will be important to determine whether these effects are also evident in clinical populations.

The emotional and behavioral consequences of dysfunction within specific attention systems are difficult to predict, owing to the multitude of intermediary processes between attention, cognition, and behavior. One might imagine that overactive orienting among youth with internalizing symptoms could, for example, cause their attention to be drawn too easily to cues (e.g., a scowling peer) that are consistent with dysfunctional beliefs (e.g., not being liked), whereas underactive alerting among youth with externalizing symptoms might cause them to persist in an undesirable behavior (e.g., an angry tantrum) despite cues that their behavior is counterproductive (e.g., impending punishment). However, due to the complex relationship between basic attention and clinical symptoms, dysfunction in different attention systems might in some cases produce indistinguishable clinical profiles. Nevertheless, the source of the dysfunction may have important implications for treatment.

Our work fits within a broader literature suggesting an important transdiagnostic role for attention in the development and/or maintenance of psychopathology (see MacCoon,

Wallace, & Newman, 2004; Taylor & Amir, 2010). However, the current evidence is rather piecemeal, with few studies investigating the role of attention across multiple clinical disorders or systematically studying a representative array of attention processes. Further research is needed to more fully delineate the contributions of attention processes to the development and maintenance of psychological disorders.

Empirical Support for Attention Training as a Transdiagnostic Treatment

Attention training, in one form or another, has long been a component of neurocognitive rehabilitation for patients with brain injuries or other neurological disorders, and there is substantial evidence that attention training is effective for these populations (see Rohling, Faust, Beverly, Demakis, 2009). There is also evidence that attention training can improve attention performance in children. Stevens and colleagues (Stevens, Fanning, Coch, Sanders, & Neville, 2008) demonstrated normalization of ERP measures of attention following 6 weeks of daily computerized training in kids with selective language impairment. Rueda, Rothbart, McCandliss, Saccomanno, and Posner (2005) randomly assigned typically developing preschoolers to five, 1-hour sessions of computerized attention training or the same number of control sessions watching children's movies. Children in the attention training condition showed significantly greater improvements in executive control and non-verbal IQ compared to children in the control condition. Although the long-term maintenance of these effects is not yet established, the improvements in IQ observed by Rueda and colleagues (2005) suggest that attention training could have important positive impacts that extend to higher-order cognitive processes. Interestingly, attention can also be improved through interventions that may not at first glance appear to target attention. For example, Slagter et al. (2007) found that 3 months of intensive meditation training resulted in increased attentional capacity. As Slagter et al. (2007) noted, much of meditation involves directing the focus on one's attention, so perhaps this finding should not be surprising. Indeed, similar improvements from meditation have been reported by other researchers (Tang et al., 2007).

Despite evidence that attention can be improved through training, few studies have examined the efficacy of attention training in clinical populations. As with the assessment of attention, attention training usually focuses on executive components of attention. A handful of studies with adult clinical populations have used Wells' (1990, 2007) clinician-administered Attention Training (ATT) program, which was designed to reduce perseverative self-focused thoughts by teaching patients to flexibly control their attention. ATT is guided by the clinician and can be easily incorporated into traditional therapy sessions. The clinical implementation of Wells' (1990, 2007) clinician-based ATT has been discussed in detail elsewhere (e.g., Wells, 2009). ATT has shown promise for reducing anxiety (Papageorgiou & Wells, 2000), depression (Papageorgiou & Wells; Siegle, Ghinassi, & Thase, 2007), hypochondriasis (Cavanagh & Franklin, 2000), and hallucinations (Valmaggia, Bouman, & Schuurman, 2007), although a recent controlled trial found no benefit of adding ATT to cognitive behavioral group therapy for adults with social anxiety (McEvoy & Perini, 2009).

Computer-based attention-training programs are becoming increasingly common in the treatment of children and adolescents. In general, these programs train attention and executive skills via a collection of computer games that progressively increase in difficulty. One example of this type of training intervention is the "Captain's Log" program developed by BrainTrain (www.braintrain.com). Captain's Log is a series of simple computerized games designed to train important attention, memory, and motor skills. Captain's Log has different "tracks" for different ages (ranging from 5 years to adulthood), and within each track the child progresses through 15 increasingly more difficult stages.

A handful of studies support the efficacy of Captain's Log for improving attention and behavior (e.g., Burda, Starkey, Dominguez, & Vera, 1994; Kotwal, Burns, & Montgomery, 1996; Slate, Meyer, Burns, & Montgomery, 1998), although there is only one published randomized controlled trial of this or similar programs for the treatment of attention difficulties (Rabiner, Murray, Skinner, & Malone, 2010). Rabiner and colleagues randomly assigned 77 first-grade students with inattentive symptoms of ADHD (85th percentile or higher on the Connors Teacher Rating Scale) to one of three conditions: Captain's Log attention training, curriculum-based computer-assisted instruction, or wait-list control. Children in the two training conditions completed two 75-minute sessions per week for 14 weeks. The attention training used a subset of the Captain's Log games that are particularly focused on attention skills (e.g., Alternating Attention, Focused Attention, Selective Attention). Outcomes such as teacher-rated attention, academic success, and reading fluency were measured at posttraining and at follow-up in the second grade. Both intervention conditions produced modest benefits in children's ability to attend in the classroom, and posttraining inattentiveness ratings were within the normal range for approximately 25% of the children who received an intervention versus only 4% of the children in the control condition. Children with the most severe attention problems also continued to show treatment effects at the second-grade follow-up assessment.

There is clearly a need for more research on the efficacy of attention training, and in particular on its utility for the treatment or prevention of psychological disorders. Nevertheless, the existence of ready-made attention training programs and the demonstrated success of attention training in cognitive rehabilitation suggest that computer-based attention training may be a feasible and useful adjunct to clinical interventions with children and adolescents.

Attention Training in Clinical Practice

The existing evidence, though limited, suggests that attention training may be a helpful treatment for youth with internalizing and/or externalizing symptoms. However, there are a number of limitations to current attention interventions. First, there are few methods for assessing well-defined attention systems in a standardized manner. Questionnaires can provide clinical cut-offs for attention problems, but are limited to executive attention and generally confound attention with other processes and behaviors. Laboratory measures of attention can differentiate attention processes but have not been standardized for clinical use. Thus, it is not yet possible to profile an individual child's strengths and weaknesses across multiple attention systems. Relatedly, existing interventions generally take a broad approach to attention training, targeting higher-order aspects of executive attention (e.g., selective attention, divided attention, sustained attention) rather than the underlying neurobiological attention systems.

Attention training interventions would benefit greatly from standardized attention assessments that could be administered to individual children to identify their particular profiles of strengths and weaknesses with regard to well-defined attention systems. Similarly, attention training programs need to be designed to target specific attention systems, including basic processes such as alerting and orienting. Interventions could then be targeted to each child's particular areas of weakness, maximizing therapeutic efficacy and efficiency.

Nevertheless, the current state of the field allows practitioners to both assess and treat important aspects of executive attention. Broad-based attention training, designed to improve executive attention skills, is an especially natural complement to common cognitive-behavioral interventions. CBT programs (e.g., Coping Cat for anxiety) guide

youth to attend to their thoughts and feelings, and to step outside these thoughts and feelings in order to develop effective coping strategies. As such, CBT programs require considerable executive control (interrupting habitual responses, redirecting attention, sustaining attention). Youth with executive attention deficits are more likely to have difficulty implementing CBT strategies. Incorporating executive attention training into cognitive behavioral therapy may help these youth develop the skills needed to successfully implement cognitive behavioral strategies for managing their emotions and behaviors.

Consider a child with poor executive attention, as assessed by parent-report questionnaires, who is being treated for anxiety with the Coping Cat program. Such a child may do well when practicing coping strategies with the therapist. However, in order to translate these strategies to the real world, the child must be able to interrupt habitual responses in anxiety-provoking situations and activate the therapeutic goals of identifying anxious feelings and using new coping skills. The ability to override well-learned behaviors and implement new strategies requires executive attention. A child with poor executive attention may do well in clinical sessions but may have difficulty generalizing their skills to the real world. Complementary attention training, focused on improving the child's ability to inhibit habitual responses and to maintain goal-directed behavior (using, for example, the attention modules of Captain's Log), would be expected to improve the child's ability to implement new coping strategies when experiencing anxiety in daily life.

Attention training can have similar benefits for children with externalizing symptoms and poor executive attention. Consider a child with disruptive behaviors who is being treated with a token-based behavior modification program at home and school. The child may demonstrate a good understanding of the desired behaviors and the reward contingencies of the token system. However, due to weak executive attention the child's knowledge may fail to consistently influence his behavior in real-world situations. That is, the child's habitual disruptive responses may often override the goal of earning tokens through positive behaviors. Complementary attention training that focuses on inhibiting well-learned responses (for example, the response inhibition module of Captain's Log) and maintaining goal-directed attention (e.g., Captain's Log attention modules) may improve the child's ability to suppress habitual but counterproductive disruptive behaviors.

As these examples illustrate, weak executive attention may impede the generalization of treatment strategies to real-life situations. Thus, one logical approach for integrating attention training into typical outpatient therapy would be to (a) routinely assess executive attention at intake, using parent- and/or teacher-report on the BRIEF or similar questionnaires, and (b) for children with deficient or borderline executive attention skills, incorporate computer-based (e.g., Captain's Log) or clinician-directed (e.g., ATT) attention training either prior to or concurrent with treatment as usual.

Computer-based attention training programs are appealing to most children and can have therapeutic benefits without feeling like an intervention. This may be a particular advantage for children who have limited insight, immature cognitive or language skills, or who are resistant to traditional therapy. For these cases, it may be beneficial to introduce attention training even if the child falls within the normal range on initial questionnaire assessments of attention. These children could have attention dysfunction that is missed by existing measures, and the appealing nature of computerized attention training may help to build the therapeutic alliance and improve compliance for other aspects of treatment. Thus, a second approach for incorporating attention training would be to offer supplemental attention training to youth who either fail to comply or fail to respond sufficiently to traditional treatment.

Practical issues in Attention Training

Equipment

Most computerized attention training programs can be installed on any personal computer running a Windows operating system, so the necessary equipment generally includes a desktop or notebook PC in a quiet location with a standard keyboard and mouse. Most broad-based attention training programs, such as Captain's Log, are self-contained and, once purchased, can be run without any additional software. Similarly, performance data are easily accessed in a clinically useful format.

Practitioners who prefer clinician-directed attention training may wish to try Wells' ATT protocol, which is available from the Metacognitive Therapy Institute (MCT-I; www.mct-institute.com). The only equipment necessary to administer the ATT protocol is a computer or MP3 player with stereo speakers.

Training

The administration of computerized attention-training programs requires minimal additional expertise on the part of the clinician. The programs are self-contained, and are completed by the client independently. Clinicians will want to familiarize themselves with the different training options, and with the interpretation of performance summaries. Wells' ATT protocol, although clinician-administered, is based on familiar therapy practices and is designed to be administered without specialized training other than gaining familiarity with the materials and protocol.

Length and Duration of Treatment

There are no empirically established guidelines for the frequency or duration of attention training. In general, more frequent practice is believed to be more effective. As noted above, Rabiner and colleagues (Rabiner et al., 2010) administered Captain's Log within a school environment and participants completed two 75-minute sessions per week for 14 weeks. However, the duration of each Captain's Log session can be as short as 5 to 10 minutes, depending upon which subtests are administered. Typical clinical use of Captain's Log might involve one or two 30-minute sessions per week throughout the duration of treatment (a minimum of 8 weeks). Captain's Log can also be purchased by parents for use in the home if additional training is desired.

Each of Wells' ATT sessions lasts approximately 12 minutes. Two or more sessions per week are preferred, but once ATT has been introduced to the client they can continue to practice the program at home. It is common for ATT to be practiced multiple times per week for 8 to 10 weeks (e.g., Papageorgiou & Wells, 2000).

Cost

Self-contained computerized attention training programs such as Captain's Log require an initial software purchase that is often in the range of a few hundred to a few thousand dollars. There are sometimes annual maintenance or subscription fees. The materials necessary for administering Wells' ATT program are available at minimal cost (see www.mct-institute.com).

Outcomes

Because there are few well-controlled empirical studies of attention training, it is highly recommend that clinicians develop a standardized treatment plan (including the number and frequency of sessions) for any attention training program they administer, and that client

progress is tracked regularly. Careful attention to the implementation and efficacy of attention training on a case-by-case and practice-wide level will help the clinician make informed decisions about when, how, and for whom attention training should be offered as an adjunct to standard treatment.

Conclusions

We have sought to demonstrate that attention is a useful transdiagnostic mechanism in the development and treatment of psychopathology. Disordered attention is associated with a range of different psychological disorders, from anxiety to conduct problems. Furthermore, interventions that target attention have produced improvements in clinical symptoms.

Our belief is not that all individuals with psychopathology have attention dysfunction, but that individuals with attention dysfunction exist within many or most diagnostic categories. Among these individuals, accurate assessment and treatment of attention dysfunction is likely to have powerful therapeutic effects due to the cascading effects of attention on a wide range of processes including academic success, self-regulation, social skills, and possibly even intelligence. With recent findings showing the plasticity of attention, and hints of broad positive effects from interventions, there is much to be gained from the clinical assessment of attention dysfunction and the appropriate remediation of deficits.

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Figure 1.

A working model for the role of attention in the development and maintenance of psychopathology.