

## **Pharmacological and Psychological Interventions for Attentional Difficulties**

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Attention describes the physical and mental processes by which we bring an object to the forefront of consciousness (Goldstein, 2007). Attention is a wide construct which consists of four distinct processes: sustained, selective, orienting, and executive attention (Tsal, Shalev, & Mevorach, 2005). To acquire knowledge and skills, individuals must select which stimulus to attend to over others, orient themselves to attend to the selected object, sustain attention over time, and inhibit undesired responses. Although all areas of attention are necessary for learning, sustained attention has been considered the most important element of attention (Tsal et al., 2005). Sustained attention is the ability to attend to a stimulus over a period of time without being distracted (Johansson, Marciszko, Gredebäck, Nyström, & Bohlin, 2015) and develops rapidly in the early years (Kannass & Oakes, 2008). Once attention has been directed towards a stimulus, it is only through maintaining concentration over time that new information can be learned and transferred to long-term memory (Baddeley, 1999). If pupils cannot sustain their attention for extended periods of time, this will negatively impact on their ability to acquire new skills and knowledge. Additionally, sustained attention is considered a key difficulty in ADHD which has resulted in a body of literature investigating interventions in this area (Johnson et al., 2007).

Due to its role in learning and as it has been the focus of many interventions, this critique will specifically focus on different interventions to improve sustained attention. Three types of interventions for sustained attention, and then implications for practitioners, will be discussed.

### **Pharmacological Interventions**

Pharmacological intervention will not be available for the majority of individuals who have difficulties with sustained attention, but for those who meet the diagnostic criteria of Attention Deficit/Hyperactivity Disorder (ADHD) medication is likely to be prescribed. ADHD is defined as a persistent pattern of inattention and/or hyperactivity-impulsivity (American Psychiatric Association, 2013), and professional guidelines recommend medication as a first-

line intervention (American Academy of Child and Adolescent Psychiatry [AACAP], 2007; American Academy of Pediatrics [AAP], 2011).

Methylphenidate (MPH), brand name Ritalin, is a psychostimulant that has been widely prescribed for the treatment of children with ADHD (Lufi, Bassin-Savion, & Rubel, 2015). Psychostimulant treatment is based on the theory that the brains of children with ADHD lack arousal, and that the observed behaviours are their attempt to seek a greater level of stimulation to enable them to function at an optimal arousal level (Long, Wood, Littleton, Passenger, & Sheehy, 2011).

Zentall (2005) described psychostimulant medications as the most effective treatment for attentional difficulties, and the rate of stimulant prescriptions has increased over the past several decades (Hoagwood, Kelleher, Feil, & Comer, 2000). In a meta-analysis, Faraone, Biederman, Spencer, and Aleardi (2006) concluded that stimulants reduce over-activity, impulsivity, and inattention characteristics as well as improving on-task behaviour.

However the mechanisms by which medications are described as treating ADHD have not gone unchallenged. Moncrieff (2008) described how chemically-based interventions for conditions such as ADHD are implicitly based on the disease-centred model. This model assumes that drugs act on the underlying physical disease processes to reverse an abnormal brain state. However Moncrieff (2008) criticised this model and instead proposed a drug-centred model which instead argued that drugs create an abnormal brain state by affecting global processes. In the treatment of ADHD, low dose stimulants create a state of reduced responsiveness. Rather than specifically targeting attentional processes, medication is instead creating passive, unresponsive individuals (Moncrieff, 2008).

The evidence describing medication effectiveness is also mixed. In a longitudinal study of children diagnosed with ADHD, Molina et al. (2009) found that individuals who were still taking medication six and eight years after beginning treatment did not differ from those who had chosen not to take medication. There was no evidence for the long-term advantage of medication treatment beyond two years for the majority of children. There are also known adverse side effects of medication. Stimulant medication was associated with a relative decrease of body weight and height still present after 72 months of treatment (Powell, Frydenberg, & Thomsen, 2015). Knowledge of the effects of drugs on brain development is limited (Volkow & Insel, 2003).

Supporters of pharmacological interventions acknowledge that medication cannot teach an individual new skills (Miranda, Presentación, & Soriano, 2002), but imply that through ameliorating attentional difficulties learning will be positively impacted. However, medication has limited effects of academic achievement (Chronis, Jones, & Raggi, 2006) and does not lead to improve long-term outcomes in higher level skills such as reading comprehension or maths problem solving (AAP, 2000).

Study design has also effected research outcomes. Lufi et al. (2015) examined the effectiveness of the drug MPH on different attentional measures. MPH treatment did improve

overall attention but no improvement in sustained attention was found. Many studies do not use such sensitive measures of different attentional processes to capture the precise effect on sustained attention.

## **Psychosocial Interventions**

### *Behavioural Interventions*

Interventions into attentional difficulties have generally focused on either pharmacological stimulant medication or psychosocial interventions (Tresco, Lefler, & Power, 2010). The most commonly studied psychosocial intervention is behavioural modification (Fabiano, Schatz, Aloe, Chacko, & Chronis-Tuscano, 2015). Behavioural interventions are based on generic theories of behaviour management developed out of operant and social learning theory (Sonuga-Barke, Thompson, Abikoff, Klein, & Brotman, 2006), and involve manipulating environmental factors that are antecedent or consequences of maladaptive behaviour to reduce unwanted behaviours and reward desired behaviours (Chronis et al., 2006).

Chronis et al. (2006) concluded that the literature clearly supports the efficacy of behaviour modification in the treatment of childhood ADHD. Many meta-analyses and systematic literature reviews have also reached this same conclusion. In a review of 12 meta-analyses, Fabiano et al. (2015) reported that overall the evidence suggests psychosocial treatments for ADHD are effective. However the authors noted the diversity of previous findings which they attributed to the range of study designs, outcome measures, and that some previous reviews had combined different types of interventions under the broad label of psychosocial treatment. In another systematic review, Evans, Owens, and Bunford (2014) reported that behaviour management interventions are well-established treatments for ADHD. Pelham and Fabiano (2008) also recommended behavioural interventions as a first-line intervention. Charach et al. (2013) recommended parent behaviour training as a first-choice treatment for ADHD in pre-school aged children.

Not all reviews have reached such strong conclusions supporting the use of behavioural interventions. In a systematic review, Sonuga-Barke et al. (2013) found that the evidence supporting psychological interventions was strongly influenced by whether the individuals providing outcome ratings were blind to treatment allocation. Other studies have also reported this effect. For example, Abikoff et al. (2015) investigated the effectiveness of parent training for preschool ADHD. Although parents reported an improvement in behaviour this was not corroborated by direct observers or teachers both masked to the treatment condition. Further research which uses blinded observers is needed to clarify the effectiveness of behavioural interventions.

Sonuga-Barke et al. (2013) concluded that the results were less supportive of nonpharmacological interventions for ADHD than previous meta-analyses. The discrepancy between reviews may lie in the fact that Sonuga-Barke et al. (2013) only included studies which used a randomised controlled trial format whereas others have not applied this

inclusion criteria. More research is needed to unpick why results vary so much between study designs.

Research into behavioural interventions has often used observer ratings rather than direct measures of sustained attention. Stronger conclusions could be reached if research used direct measures of sustained attention rather than relying so heavily on observer measures. It is also problematic that research has focused on participants with ADHD. Many young people will have attentional difficulties but not meet the criteria for a formal diagnosis of ADHD. It is not conclusively demonstrated that lower level sustained attention difficulties may be appropriately targeted through behaviour interventions.

The criticism of whether interventions aimed at improving sustained attention lead to improvements in learning can be levelled at behaviour interventions as well as medication. Individuals with ADHD have an academic disadvantage (Raggi & Chronis, 2006), and whilst outcome measures are focused on inattention, rather than investigating academic outcomes, it is unknown whether behaviour interventions help improve academic outcomes for pupils.

### *Cognitive Training*

Cognitive training has been classified as a unique intervention and also viewed as a type of psychosocial treatment (Hodgson, Hutchinson, & Denson, 2014). Regardless of their specific classification, the evidence examining them will be included in this critique as they are an intervention aimed at improving sustained attention.

Cognitive interventions aim to directly improve cognitive processes underlying sustained attention, requiring individuals to practice specific tasks designed to tap into attentional processes (Rajender, Malhotra, Bhatia, Singh, & Kanwal, 2012). Posner, Sheese, Odludas, and Tang (2006) proposed the concept of attentional networks, suggesting that specific attentional brain networks develop during childhood and arguing that this provides a rationale to investigate whether the attentional abilities of children can be improved.

Research has reported a positive effect of cognitive training programmes on sustained attention. Kerns, Eso, and Thomson (1999) found that an intervention using visual materials lead to improvements in sustained attention. The same intervention was investigated by Tamm, Epstein, Peugh, Nakonezny, and Hughes (2013) who reported a reduction in ADHD symptoms from both parents and clinician. A strength of these studies is that direct measures of sustained attention were taken.

There are many computerised attentional interventions. Shalev, Tsal, and Mevorach (2007) used computerised attentional training which included four sets of tasks each designed to train the four attentional networks. Significant improvements in academic tests and parents' behavioural ratings were reported. Rabiner, Murray, Skinner, and Malone (2010) found that after using computerised attentional training, students showed a decrease in teacher ratings of attention problems. Steiner, Sheldrick, Gotthelf, and Perrin (2011) found that computerised attentional training reduced parent-reported ADHD symptoms.

Some computerised interventions use neurofeedback to train attention. Neurofeedback is a form of operant conditioning where physiological changes are fed back to individuals as they occur so that through monitoring they can learn to regulate their mental state (Gruzelier, Foks, Steffert, Chen, & Ros, 2014). Steiner, Frenette, Rene, Brennan, and Perrin (2014) found that parents reported an improvement in attention both immediately at post-test and six months after the neurofeedback intervention had ended. Gruzelier et al. (2014) also concluded that a neurofeedback intervention benefited pupils' sustained attention.

These studies indicate a growing body of evidence supporting the use of cognitive interventions to improve sustained attention. However methodological considerations mean that caution is needed when interpreting the results. The majority of the studies described did not use direct measures of attention but relied on observations from parents, teachers, or clinicians (Rabiner et al., 2010; Shalev et al., 2007; Steiner et al., 2011; Steiner et al., 2014). Attention is a complex term consisting of four processes (Tsal et al., 2005). When asking observers to rate attention, it is not possible to be sure that all observers are considering the same areas of attention. Another concern regarding cognitive interventions is transfer effects. An individual may become more skilled at completing intervention activities and tasks similar to these, near-transfer effects, but may not be able to use these new skills in dissimilar tasks such as classroom learning, far-transfer effects (Rapport, Orban, Kofler, & Friedman, 2013). If the outcome measures used in the study are similar to the intervention activities, near-transfer effects may make it seem that meaningful changes have occurred in sustained attention which are not actually transferring to the classroom.

In a review of the literature into using technology to support children with ADHD, Xu, Reid, and Steckelberg (2002) concluded that although studies often report positive results of computerised attentional training, serious methodological problems mean that no firm conclusions are possible.

## **Wider Concerns**

### *Sample Characteristics*

Because difficulties with sustained attention are considered to be a major factor in explaining the difficulties of ADHD (Epstein et al., 2003; Johnson et al., 2007), the majority of studies investigating sustained attention recruit participants with this diagnosis. However Tsal et al. (2005) investigated the performance of children with ADHD on four sets of attentional tasks and reported that individuals showed deficits in the different areas of attention. The authors concluded that individuals with ADHD cannot be treated as a single group, as they currently are. Furthermore, inattention is common among all individuals (Wolraich, Hannah, Baumgaertel, & Feurer, 1998). It is not known how generalizable results of studies using participants with ADHD are to students in school with lower level difficulties in sustained attention.

### *Ethical Concerns*

The precise language used to describe ADHD (e.g. AAP, 2011) gives the impression that attentional difficulties are straightforward to identify. Yet Timimi (2005) highlighted that as inattention is found in all individuals to some degree, ratings of it are highly culturally sensitive. What is considered to be inattention will differ between cultures, and the beliefs and perceptions of the individual responsible for rating behaviour will affect if a diagnosis of ADHD is given (Timimi, 2005). The long-term effects of psychostimulant medication are not well understood (Volkow & Insel, 2003). There appears to be an ethical issue in large numbers of children and young people, whose brains are in a sensitive period of development, being prescribed medications for attentional difficulties which are highly dependent on culture, and could be improved through interventions without medication.

### *Why Inattention?*

A broader issue in attentional interventions is why this area is being selected as a target area for intervention. Attending to something is considered the first step in learning (Woolfolk, Hughes, & Walkup, 2013) and poor academic outcomes are linked to attentional difficulties (Raggi & Chronis, 2006). The reason that sustained attention has been the target of intervention may be because of the consequences of inattention on learning. However even if some interventions do improve sustained attention, which cannot necessarily be concluded from the evidence base, it does not automatically follow that this will translate into improved attention in the classroom and academic progress. Few studies investigate changes in academic learning that may occur over the course of the intervention (Raggi & Chronis, 2006).

### *Changing Individuals or Systems?*

It seems useful to be aware that children who find sustaining attention difficult will also encounter difficulties in learning. However it appears that many researchers and educators have accepted a within-child perspective, that attentional difficulties can be targeted through direct intervention, and this will therefore have a positive impact on learning. An alternative perspective would be to consider the interaction between the individual and their environment in determining attention, with the aim that manipulating how material is taught may support both sustained attention and learning.

In a review of strategies for attentional problems, Zentall (2005) highlighted that interventions focused on adding novel stimulation have produced improvements in sustained attention to the point where children with ADHD have outperformed matched control groups. Leung, Leung, and Tang (2000) found that the performance of children with ADHD on attentional tasks normalised when extra visual stimulation was provided. This result has been replicated in academic tasks. Abikoff, Courtney, Szeibel, and Koplewicz (1996) reported that the arithmetic performance of children with ADHD improved with musical stimulation. Imhof (2004) found that colour stimulation improved attentional control during a handwriting task. Rabiner et al. (2010) found computer aided instruction reduced inattentive behaviour and lead to gains in reading fluency.

A focus on interventions aimed at improving attention assumes that individuals have a trait level of attention which is constant and does not consider the impact of their environment. Attention is strongly determined by environmental factors, including the novelty of stimulus (Garon, Bryson, & Smith, 2008).

### **Implications**

Educational Psychologists (EPs) can work with schools to help them understand the reasons why they may be concerned about sustained attention, and that this is perhaps to improve academic progress. EPs are well-placed to move the debate away from a within-child perspective, centred on which intervention is more effective, and encourage an interactionist perspective of how attention is affected by the environment. This change can then lead to consideration of the learning environment and a change in classroom teaching.

EPs can also challenge the disease-centred model underlying pharmacological interventions whilst being aware of their own professional limits, that they do not have responsibility for prescribing or discontinuing medication. The profession has an ethical duty to communicate research findings and challenge others' beliefs. Many parents feel that medication is effective because symptoms appear to return as a dose wears off (Hansen & Hansen, 2006). Yet Moncrieff (2008) described the phenomenon of tolerance, the physical adaptations that take place in the body if drugs are taken on a long-term basis. These adaptations counteract the immediate effect of the drug so that larger doses are required to achieve the intended effect. Tolerance also means that if a drug is stopped or reduced, these adaptations are then unopposed by the presence of the drug which causes withdrawal symptoms. Individuals often mistake these withdrawal symptoms for proof that their original symptoms are returning without the drug to control them. EPs can help reframe the effects of a reduction in medication as withdrawal effects rather than symptoms, and explain the range of environmental changes and psychosocial interventions which may improve attention.

### **Summary**

In summary, pharmacological intervention for ADHD is common but questions remain about the mechanisms by which stimulation medication is acting, its effectiveness, and its long-term impact on individuals. It is ethically uncomfortable to place such a large portion of society on powerful medication with these issues unresolved for a culturally dependent construct. The evidence suggests that behavioural interventions and cognitive training may positively impact on attention although more rigorous research using blinded observers, direct measures of specific attentional process, academic outcomes, and with wider samples is needed before stronger conclusions can be drawn.

Rather than being drawn into the debate about which specific attentional intervention is more effective, EPs can consider the broader question of how do we improve attention for learning. This means being aware of the impact of the environment on attention, and the effect of adding novel stimulation to a classroom rather than putting in place an intervention focused on changing within-child factors.

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## Appendix

As I began work on this academic critique, I was aware that I needed to understand current theory on the development of attention before I could investigate attentional interventions. I therefore used the PsycInfo database to search for the terms “development of attention” and “child\*”, narrowing results to peer reviewed papers published between 2006 and 2016 to which I had full-text access. I chose to narrow results to the previous decade because I wanted to form an accurate understanding of how attention is currently conceptualised. This search lead me to the paper written by Johansson et al. (2015) which described sustained attention in infancy as well as the different terms used in the literature. Following up references from this paper and the search described above gave me a good understanding of the different attentional processes, and how attention develops over childhood.

Having read about psychostimulant medication used as an intervention for ADHD, I then searched PsycInfo for the terms “sustained attention”, “intervention”, “medication”, and “child\*” again narrowing results to peer reviewed articles to which I had full-text access published between 2006 and 2016. This search provided the majority of evidence for the pharmacological section of the academic critique, and I followed up references where necessary, such as finding the guidelines published by the AAP and AACAP. This search also linked me to the paper by Zentall (2005) which provided me with many references for environmental strategies to use for inattention.

I conducted three further searches of PsycInfo, using the same narrowing criteria, for the terms: 1) “sustained attention”, “intervention”, “psychological”, and “child\*”; 2) “sustained attention”, “intervention”, “psychosocial”, and “child\*”; and 3) “sustained attention”, “intervention”, “cognitive”, and “child\*”. These results provided evidence for the psychosocial interventions into sustained attention. As well as using the results from PsycInfo, several meta-analyses provided a range of interesting references which I followed up so I could read the original papers.