

A user’s Guide to the Brain: Attention Deficit Hyperactivity Disorder (ADHD): Sustained Attention in UK primary aged (5-11) children.

Introduction

Teacher’s and other Educational Practitioners, such as Teaching Assistants (TA), Head Teachers, and Special Educational Needs Co-ordinators (SENCO) arguably have a vital role in the diagnosis and intervention of Children with ADHD (Russell, Moore, & Ford, 2016). Despite this, there are sometimes misperceptions surrounding ADHD, which can influence the diagnosis and treatment of ADHD (Russell, Moore, & Ford, 2016). As such, this guide has been created to clear up any possible misperceptions surrounding ADHD and relays evidence based around Neuropsychology and surrounding fields to back-up the points made. The guide also aims to offer practical advice and understanding of symptoms of ADHD for Educational Practitioners, with special interest taken in a child’s ability of vigilance (referred to within the guide as ‘sustained attention’). In this guide the reader will find information relevant for Educational Practitioners in a variety of ways: What (sustained) attention is; the symptoms of ADHD; what does (and does not) cause ADHD; Potential interventions for improving sustained attention of children with ADHD of primary education aged (5-11); how Educational Practitioners can make use of this information to offer their support to children with ADHD.

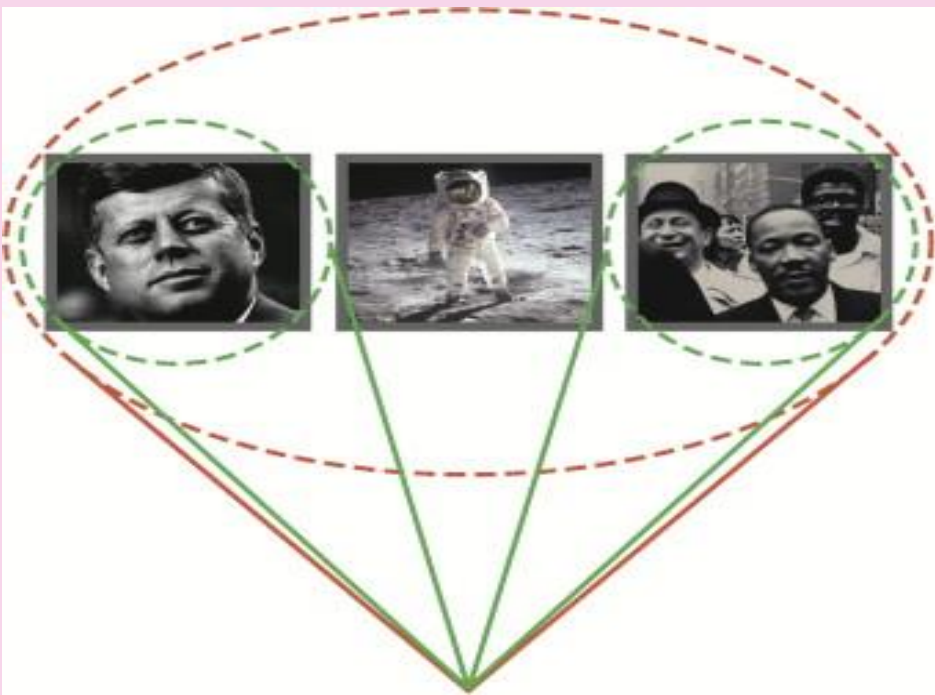


Figure 1.1 demonstrating how attentional spotlight can focus between left and right sides, leaving out the centre image.

Pay attention

Anyone visiting a classroom, or remembering from their schooldays, will undoubtedly have witnessed a teacher (or all of them) shouting for students to “Pay attention!”. The metaphor of a spot-light of attention (Figure 1.1) serves as a useful introduction as one can picture shining the spotlight to focus attention, sustaining it in an area, and being able to move it due to internal or external factors (Tong, 2004). However, the metaphor does not quite adequately capture everything that is studied regarding attention in Neuropsychology; this field of inquiry being the study of the relationship between the physical factors in the brain and relating it to cognition and behaviour.

When one talks about attention, it’s necessary to note the distinction between endogenous (internal) and exogenous (external) factors that determine what we pay attention to, for how long, without getting distracted. These factors can also be combined, in scientific models, to understand how they can work together as well during the impingement upon multiple sense-organs such as the eyes and ears (Tang, Wu, Shen, & Tang, 2016). This information will be important to remember when it comes to thinking about ADHD in children, which will be discussed towards the end of this guide, as they struggle to meet goals set in a classroom environment due to an inability to sustain attention (Slobodin, Cassuto, & Berger, 2018).

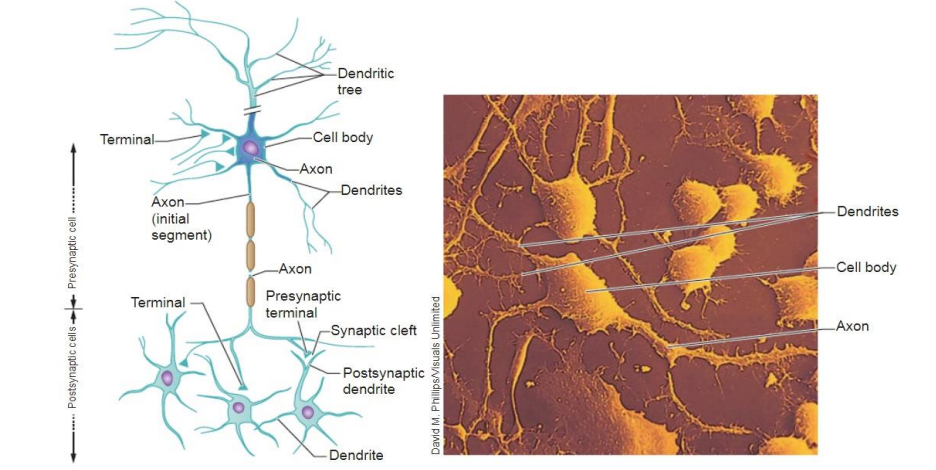
Defining Attention

From a Neuropsychological standpoint, there needs to be a further sub-definition of what is meant by ‘attention’ as it is studied. At least four divisions can be made: vigilance; arousal; divided attention; and selective attention (LaBerge, 1990). Vigilance is concerned with sustaining attention and thus referred to within the guide - for the sake of simplicity - as sustained attention. This type of attention will be the main focus of the guide. Arousal might be what one thinks of when shouting for a child to “pay attention!”, as it alerts the person and causes a shift in eye-movement or orientating of the body to see what is the cause of the noise, for example. Divided attention in everyday use can be thought of as multitasking; the extent of a person’s ability to do two or more tasks simultaneously. Selective attention is similar to the “spotlight” metaphor, where a person can focus on one thing rather than another.

Unified Theories of Attention

Thus far, Neuropsychological approaches to understanding attention have struggled to develop a unified theory of attention, though attempts have been made to in regards of this in those without impairment or dysfunctions (Duncan, 2006) as well as developing scientific models for attention (Corbetta & Shulman, 2002). That is not to say real progress has not been made, and continues to be made, in Neuropsychology as it uncovers the role of the brain as it relates to different aspects of attention. We can say, for example, that current research views the brain to be operating in such a way that no one ‘centre’ of localisation is responsible for attention, as the neural network in the brain involves ‘brainstem, midbrain, and forebrain structures’ (Stirling & Elliott, 2010, p. 218).

Figure 1.2 the structure of the neuron cell.



Neuropsychology & Attention

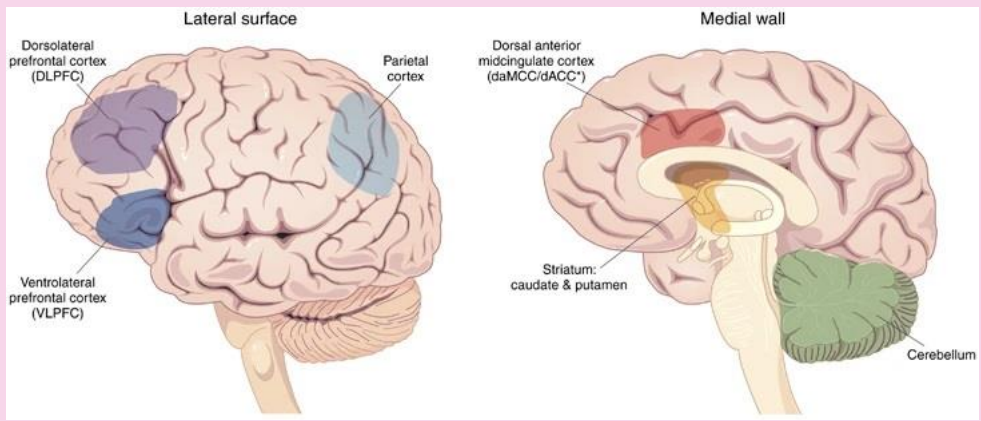
By modelling the brain in a neural network, scientists aim to understand how the brain works in relation to the neurons firing inside as a system, and what this means for humans in terms of cognition, perception, and behaviour. In figure 1.2, we can see the structure of the neuron cells (Banic & Compton, 2018). The essential information is that neurons communicate with each other, inside a network within the brain, by firing electrical currents; the axons send information, and the dendrite receives information. It can be concluded from evidence that this is how the brain functions; neurons firing within relatively small neuronal networks because the size of the brain would be over 12.5 miles in diameter if each neuron connected to every other neuron (Nelson & Bower, 1990, cited in Ward 2015). This seems to suggest a similar rationale that makes the case for there not being a localised ‘centre’ for attention in the brain (Stirling & Elliot, 2010). This evidence from studying the brain suggests that how neural networks work has implications for children with ADHD as will be discussed in the section on Neuropsychological views of what may cause the condition.

Possible causes of ADHD

Within the literature of ADHD, there are several possible factors that have been suggested which may be responsible for the causes of ADHD; what is strongly inferred is that ADHD is highly heritable and can be caused by genetic factors (Millichap, 2011). On the other hand, it can be due to acquired and environmental factors (Millichap, 2011), as well as most notable for the guide: brain structure abnormality - including function (Qiu, Ye, Li, Liu, Xie, & Wang, 2011; Cherkasova, Sulla, Dalena, Pondé, & Hechtman, 2013). In figure 1.3 the Brain Structures implicated in ADHD are displayed, with “all key elements of cognitive/attention networks” found to be underfunctioning (Bush, 2010, p. 282). Furthermore, building on altered structural differences Qiu et al. (2011) a more recent study (Li, Li, Niu, Xiang, Cao, Liu, Zhang, Wang, 2019) to examine whether hemispheric (right and left side brains) asymmetries proved to be related to clinical variables was conducted. Li et al.’s (2019) study showed that the right hemisphere in ADHD patients lacked the positive asymmetry found in the control-group, further demonstrating a problem with functionality compared to a child’s development compared to peers.

A problem with root cause(s) and diagnosis is that, whilst there is ample evidence of cases with probable cause cited within Millichap (pp. 9-30, 2011), the physician’s guide goes on to state there that “ A majority of cases of ADHD are idiopathic or of uncertain cause.” (Millichap, 2011). This suggests there may be situations wherein, inadvertently, it can lead to an incorrect diagnosis of another disorder for a child such as anxiety, especially if the child is of ‘inattentive’ type struggling with attention (Weissenberger, Ptacek, Klicperova-Baker, Erman, Schonova, Raboch, & Goetz, 2017).

Figure 1.3 affected regions of the brain relating to attention and cognition in ADHD sufferers



Further Biological Evidence

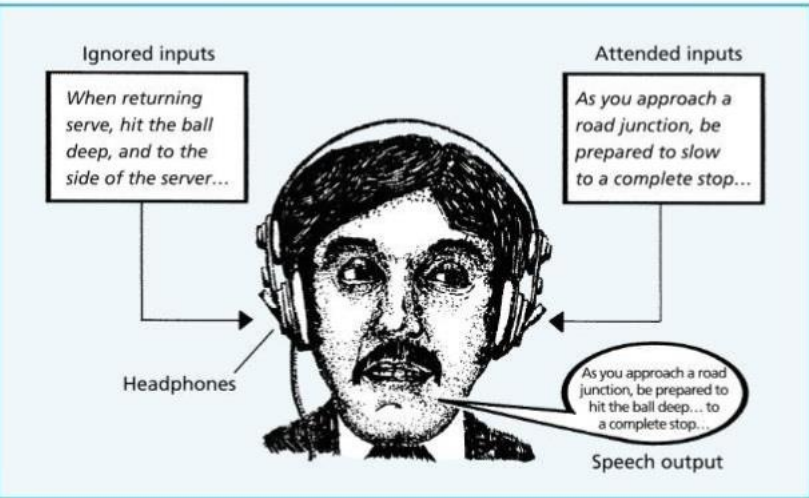
An important point to keep in mind for Educational Practitioners reading this guide is that there are compelling bases for ADHD to be linked to biological developmental progress related to brain function and structure compared to their non-ADHD peers. These points come from neuropsychological (Kalff et al., 2003), neuroanatomical (Krain & Castellanos, 2006; Smith, Taylor, Brammer, Toone, & Rubia, 2006), and electrophysiological (Yordanova, Kolev, & Rothenberger, 2009). Thus, a multitude of studies from different perspectives using different methodologies suggest that attentional delay in terms of child development is a factor. Expanding on this, it is important to recognise a child with ADHD within relation to their peer’s development is quite compellingly, at least in part, biological and related to the structure and function of the brain (Qiu et al., 2011; Li et al., 2019; Cherkasov et al., 2013). A child at ten years of age, for example, would commonly have more attentional capacity than compared to an eight, compared to a six-year-old. Therefore, when seeking guidance from a professional such as a clinician or psychologist it is important to have Educational Practitioner’s input of how the child compares to their peers, assessed across multiple domains (Holmbeck, Greenley, & Franks, 2003, cited in Young & Myanathi Amarsinghe, 2010). Once more this indicates the role the Educational Practitioner has to play is vital at especially at the stage of referral and diagnosis (Russell, Moore, & Ford, 2016) as it would seem to suggest it will ensure the success of the child in coping with their ADHD symptoms during primary school ages.

Intervention & Strategies

For younger children, at the ages of primary schooling in the UK, evidence from a meta-analysis of studies suggests one of the best approaches of dealing with sustained attention is to offer behavioural treatments with “consequences that are tangible, offered frequently, and presented immediately” (Young & Myanathi Amarsinghe, 2010, p. 117). Arguably, understanding the brains’ role in ADHD and how the developmental process is impaired comparatively to their peers (Kalff et al., 2003; Krain & Castellanos, 2006; Smith et al., 2006; Yordanova, Kolev, & Rothenberger, 2009), teachers can take a compassionate role whilst still offering behavioural approaches to interventions that they are used to and that are suggested to be effective in the literature mentioned in the meta-analysis provided by Young & Myanathi Amarsinghe (2010). By offering interventions in a non-judgemental capacity, devoid of misperceptions, Educational Practitioners truly do have, as Russell, Moore, & Ford (2016) state, a vital role to play for children with ADHD.

As an Educational Practitioner, it might be useful to try a more active teaching approach, rather than a passive one, with some general tips found in Rief’s (2016, pp. 179-180) book for sustaining attention. Notable advice for sustaining attention is keeping the information presented relevant to the student, and to tailor it to their needs (Rief, 2016, p. 179). The evidence from Slobodin, Cassuto, & Berger (2018) concurs with Rief’s (2016) views, as “detailed results suggested that sustained attention, characterized as the ability to concentrate on a specific stimulus over a period of time, develops slower but normally”. Thus, compared to their peers, children with ADHD have a harder time sustaining attention (Slobodin, Cassuto, & Berger, 2018) therefore it is recommended that irrelevant stimuli should be avoided whenever possible. Slobodin, Cassuto, & Berger, (2018) used a standard test for measuring sustained attention and vigilance lending credibility to the findings. Again, from a Neuropsychological standpoint, this indicates a developmental inability due to factors relating to brain function across multiple neuronal networks, evidenced from single-photon emission computerized tomography results (Yassin, Spengler, Amen, Willeumier, Taylor, Golden, 2014). The implication of this is that whilst several regions of the brain impact on the onset of ADHD (Yassin et al., 2014), a noteworthy instance is the impairment of the parietal lobes, as this region of the brain is related to attention being grabbed by exogenous stimuli which incidentally would break sustained attention in a child, relating back to points made earlier concerning problems with sustaining attention for children with ADHD (Slobodin, Cassuto, & Berger, 2018; Rief, 2016; Cherkasova et al., 2014).

Figure 1.4 a typical dichotic listening experiment



An experiment to try

For those Educational Practitioners seeking a personal connection to the information presented, an app called iDichotic is available to download from Dichotic Listening (www.dichoticlistening.com). See figure 1.4 for a representation of a dichotic listening experiment (Stirling & Elliott, 2010). This app allows the user to test selective attention and highlight which side of the brain has higher preference for listening tasks. Whilst doing so, the Educational Practitioner can be acutely aware of how the hemispheric advantage for attention is not available to children with ADHD (Li et al., 2019). Thus, in individual teaching, the Educational Practitioner might find that sitting on one side or another is advantageous to learning progress for the child with ADHD, and thereby the objects of salience and relevance can be put to this side to possibly limit exogenous distractions and increase sustained attention.

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