Attention: some perspectives on its disruption in mental health, and in mental illness (including ADHD-ADD and dissociative disorders)

E. J. Parkins PhD PhD
Email: ericparkins@hotmail.co.uk

Abstract

The complexity of phenomenon of attention is noted. The DSM-V diagnostic criteria for inattention are summarized, along with some related charactersistcs of dissociative disorders.Various psychological aspects of attention deficit are explored including inattention due to overstimulation, or due to lack of sufficient motivation. Other aspects explored include distractibility, and disruption by 'task unrelated thoughts'. Attention deficits are contextualized in terms of executive function. The notion of dysregulation of attention is considered in relation to brain function, with comments on the role of neurotransmitters, and cautions regarding the use of medication in the treatment of attention deficits within ADHD. Some consequences of simultaneous multiple signal inputs to the 'screen' of attentive consciousness are outlined. A number of specific 'process related categories' of attention deficit are proposed. The point is made that *not all disruption of attention is dysfunctional* and indicative of dysregulation! A list of some factors that could contribute to the appearance of 'attention deficit'-like symptoms is provided.

This introductory 'mini-paper' is a preliminary excursion into the topic ***the central role of attention*** *in a diverse range of 'mental illnesses', including ADHD, prior to a more extensive and detailed treatment in totalBRAINtotalMIND Vol.2. Explorations in Neuropsychological Diversity*

It contains modified selected extracts from: totalBRAINtotalMIND Vol.1. An Integrated Brain/Mind Architecture, which is now available as an e-book from: http://totalbraintotalmind.co.uk/

Preface: 'Attention' is a complex phenomenon

As indicated in my Academia.edu paper 'Attention: a neuropsychological perspective', the *neurophysiology* of the attention process is complex (involving multi-system interactions). Furthermore, the *neurochemistry* of attention related processes is complex: information flow between the environment and the cerebrum, the environment and the cerebellum, and between the cerebellum and cerebrum, appears to be controlled by a number of interacting brainstem neurotransmitter or neuromodulator systems. Furthermore, as indicated in my Academia.edu paper 'Attention: some psychological aspects', what is loosely referred to as 'attention' is influenced by, and inextricably involved in the conscious experience and expression of, a variety of psychological processes.

Overall, taking into account the complexity of the *psychological*, *neurophysiological*, and *neurochemical* dimensions of attention, and the fact that these dimensions are *inter-related*, it is evident that the general process that is described as 'attention', is by no means simple. Accordingly, it is important that any attempt to understand what underlies, or what contributes to, the appearance of characteristics that are described as symptoms of attention 'deficit', should take into account the fact that attention is a complex phenomenon. So too, should any approach to 'diagnose' or 'treat' those individuals who *appear* to have such a 'deficit'.

DSM-V diagnostic criteria for inattention (ADHD)

DSM-V (p.60) provides a number of diagnostic (symptomatic) criteria for inattention including the following (which most *directly* relate to attention):

- fails to give close attention to details (e.g., overlooks or misses details)
- easily distracted by extraneous stimuli (may include unrelated thoughts)
- does not seem to listen when spoken to directly (e.g., mind seems elsewhere, even in the absence of any obvious distraction)
- difficulty sustaining attention in tasks (e.g., difficulty remaining focused during lectures,conversations, or lengthy reading)
- does not follow through on instructions (e.g., starts tasks but quickly loses focus and is easily sidetracked)

These symptoms can be summarized as *a problem with maintaining focused (selective) attention*, which in part may be due to susceptibility to being distracted by stimuli of non-external origin (e.g. un-related thoughts, or, the 'mind seems elsewhere').

DSM-V on dissociative disorders and intrusions into consciousness

DSM-V describes a number of types dissociative disorder. Within the various types there are certain symptomatic characteristics that are of particular interest in relation to the process of (conscious) attention. Individuals with dissociative identity disorder experience recurrent, unbidden intrusions into their awareness or conscious functioning (e.g., intrusive voices, thoughts, and emotions). For some individuals, voices are experienced as multiple, perplexing, independent thought streams over which the individual experiences no control. In some instances symptoms may include dissociative trance, and non-epileptic seizures may be prominent in some presentations of dissociative identity disorder (DSM-V 2013).

Regarding dissociative disorders it is of note that they are frequently found in the aftermath of trauma, and that stress often produces transient exacerbation of dissociative symptoms that makes them more evident (DSM-V 2013). Given their link with trauma, it is unsurprising that one category of intrusive 'thoughts' is 'flashbacks'.

In DSM-5, the dissociative disorders are placed next to, but are not part of, the trauma- and stressor-related disorders, reflecting the close relationship between these diagnostic classes.

Psychological aspects of attention deficit

Inattention due to overstimulation

It has been suggested that inattention may entail a vulnerability to overstimulation (Jones & Allison, 2010). The conscious cerebral system may be exposed to excessive sensory stimulation arising from the external environment (various different modalities including sight, sound, smell etc.). Alternatively, it may be exposed to excessive internal stimulation (Jones & Allison, 2010). The internal source of stimulation may be bodily sensations, for example, regarding hunger or pain, or the internal stimulation may be of an emotional-cognitive nature, for example regarding learning based fear.

The notion of 'over' stimulation clearly assumes that a relative limit has been exceeded. In information processing terms this could be described as 'signal-to-noise'ratio. If the 'noise' (cerebrally unwanted sensory information) sufficiently exceeds the 'signal' (cerebrally wanted sensory information) then the signal will not be 'read' adequately. The relative excess could be because the sensory 'noise' it too strong,

or the sensory 'signal' is too weak. In relation to one sensory input (external- words from another person) competing with another sensory input (internal - pain from the body), if the 'noise' of the pain is too high, it will drown out the 'signal' of the words being spoken. Another reason for an the 'signal' being drowned out could be because the modality of the 'noise' is af a kind where there is an 'oversensitivity' of the sensory receptors, relative to the sensitivity of the receptors for the modality of the 'signal'.

Inattention due lack of sufficient motivation

What is attended to in perception, is partly constituted by cares and concerns (Maiese, 2012), that is, by what motivates us. This will include motivation at a primary process 'emotional' level (Maiese, 2012).

If the motivationally related importance value (interest value) of the 'noise' information is greater than the motivationally related interest value of the 'signal' information, then it is likely that the 'noise' will capture the attention, and the person will be distracted from the 'signal'. In short, if what the cerebral conscious mind is supposed to be attending to is 'boring' (or relatively unimportant), then a more interesting (or relatively more important) input will be likely to capture cerebral attention, even though it is not that to which the cerebral conscious mind is supposed to be attending. This may be relatively more likely to occur when the attention demanding task is one that has been 'imposed' by another person (e.g by a teacher or employer), than when the task has been self-selected.

Levels of control and levels of motivation

Primarily, there are three levels of control, and correspondingly, three levels of motivation:

- Brain stem system motivation - innate
- Cerebellar system motivation - learned
- Cerebral system motivation - learned

The basic three tier nested hierarchy of brain stem, cerebellum and cerebrum can be sytematically increased in complexity to allow for limbic levels and hemispheric divisions (with an accompanying increase in the complexity of neurotransmitter involvement). A more substantial exploration of the neurology of attention is provided in *totalBRAINtotalMIND Vol.1. An Integrated Brain/Mind Architecture.*

Controlled interruption of selective attention as a part of shifting attention

Before exploring aspects of attention 'deficit', such as 'distractibility', 'disruption' and 'intrusion', it is important to note that the lower level automatic processing system has the power to interrupt the ongoing controlled and attentional processing at the conscious level, because it is important to facilitate reallocation of focal attention to potentially dangerous, unexpected, or novel events. *Controlled interruption of selective attention is a natural and important part of the overall process of attention.*

Distractibility

Distractibility in ADHD might arise from increased sensory-driven interference, or from inefficient top-down control (Friedman-Hill, et.al., 2010). It has also been suggested that distraction could be a result of inadequate interest in the task (Reisberg & McLean, 1985), and even the result of a need to avoid boredom (Levin, 2002). However, some research indicates that even when the distractors are interesting, their distracting effect can be over-ridden if the attending person is sufficiently motivated (Reisberg & McLean, 1985). The dramatic impact of motivation has led some researchers to question if attention is ever really out of control (Reisberg & McLean, 1985), and even to suggest that ". . . it is an open question whether the entire account of distraction might be framed in terms of motivation." (Reisberg & McLean, 1985, p304).

Attention depends upon cognitive load

For some people, inefficient engagement of attention in ADHD may occur under low cognitive load, but not under high cognitive load (Friedman-Hill, et.al., 2010). In relation to cognitive load it is considered that difficult tasks minimise unrelated thoughts because they stimulate engagement of executive control processes to meet task demands (McVay & Kane, 2009). In the absence of high cognitive load, for example, in the execution of some routine tasks, it is possible that the non-conscious automatic control system would in itself be good enough for effective control, and under such circumstance, the conscious cerebral mind could simply be disengaged or dissociated.

Disruption of on-task thoughts by task unrelated 'thoughts' (TUT's)

It is considered that, in response to external and internal cues, a stream of 'thought' is automatically and continually generated (McVay & Kane, 2009). The automatic stream of thought may be an expression of (Freud's) primary process thinking (Jones & Allison, 2010), and have sensori-motor, embodied, pre-rational, pre-reflective, and 'emotional' yet 'cognitive' content (Maiese, 2012). Such non-consciously generated 'automatic thoughts' *may or may not* be related to a task that is simultaneously being carried out at a conscious cerebral level. In so far as the task unrelated 'thoughts' (TUT's) disrupt the 'on task' thoughts of the conscious system, they can be considered as ". . .a disturbance at the interface between internal psychic reality and conscious awarenss of external reality" (Jones & Allison, 2010, p284).

It has been suggested that disruption by task unrelated thoughts represent an executive-control failure to maintain on-task thoughts and/or to keep these TUT's out of the focus of attention (McVay & Kane, 2009).

Introspective attention

A conscious choice to pay attention to streams of thought from the cerebellum (in the form of primary process imagery, and/or the nonconscious 'inner voice') could be considered to be form of introspection, and described as *introspective attention*. Although this would result in lack of attention to input from the external world, and have characteristic of dissociation, as a conscious choice it would not necessarily be an attention deficit so much as an attention redirection.

ADHD and executive function (EF)

There have been a number of suggestions that attention deficits in ADHD may stem from failure to efficiently engage top-down inhibitory control (Barkley, 1997; Durston, 2003; Friedman-Hill, et.al., 2010), rather than an inability to implement filtering in sensory processing regions (Friedman-Hill, et.al., 2010). This failure to efficiently engage top-down inhibitory control can be seen as an aspect of executive-control failure (Koziol & Budding, 2012; McVay & Kane, 2009). Indeed, in a recent review paper *"Requiem for a diagnosis: attention-deficit hyperactivity disorder"* it was concluded: "ADHD . . . . . can be considered a very general "EF" disorder most often characterised by defective response inhibition, which represents a disorder of intention rather than a disorder of attention." (Koziol & Budding, 2012, p4).

Brain and attention deficit

According to Vaidya & Strollstorff, cognitive neuroscience studies of ADHD suggest multiple loci of pathology with respect to both cognitive domains and neural circuitry. With regard to atypical functional anatomy a number of region have been implicated beyond the cerebral neocortex, for example, limbic regions, and the cerebellum (Durston, 2003; Levin, 2002; Vaidya & Strollstorff, 2008).

Interaction of the cerebellum and cerebrum

Interaction between the cerebellum and cerebrum is a core feature of many psychological processes, and information flow between the cerebellum and cerebrum appears to be controlled by a number of interacting brainstem neurotransmitter or neuromodulator systems including: norepinephrine, serotonin (5-HT), and GABA. 'Malfunction' of the control of information flow from the external environment to the cerebrum and from the cerebellum to the cerebrum may have consequences that impact the efficiency of a wide range of psychological processes, and in some instances may manifest as symptomatic characteristics of attention deficit disorder (ADD/ADHD), and in more extreme instances, as symptomatic characteristics of dissociative personality disorder, or of schizophrenia, for example, as auditory verbal hallucinations (AVH's). It is therefore no surprise that neuromodulator dysfunction is often seen as central to understanding disorders from a biological perspective: "*Abnormalities in the regulation of neurotransmitter release and/or abnormal levels of extracellular neurotransmitter concentrations have remained core components of hypotheses of the neural foundations of behavioural and cognitive disorders and the symptoms of neuropsychiatric and neurodegenerative disorders.*" (Sarter, Bruno & Parikh, 2006, p1452).

Dysregulation, Neurotransmitters, ADHD, and medication

The processes of maintaining attention, and shifting attention, involve a number of neurotransmitters or neuromodulators that have a complex inter-relationship (*tBtM Vol.1*). The pathophysiology of ADHD includes dopaminergic as well as noradrenergic neurotransmitter systems (Vaidya & Strollstorff, 2008), for example dysfunction of neurotransmitters, dopamine (DA) and norepinephrine (NE) (Levin, 2002; Vaidya & Strollstorff, 2008).

Theoretically, there is the possibility of individual differences in 'neurochemical hardware', with some individuals being relatively deficient in terms of levels of availability of certain neurochemicals. Dysfunction of the attention process resulting from such a neurochemically based deficit would be constantly present unless 'treated'.

To the extent that the symptoms of ADHD arise as a result of neurochemical deficiencies or imbalance, their remediation or moderation would arguably require a biochemical intervention through the administration of appropriate medication (and/or perhaps a controlled nutritional intake). However, it is important to be aware that *a checklist based symptomatic diagnosis will not necessarily distinguish between neuropysiological causes and psychological causes*.

A caution regarding treatment of attention deficits by medication

To the extent that the attention deficit related symptoms of ADHD do *not* arise as a result of neurochemical deficiencies or imbalance, their treatment by biochemical may *not be an appropriate long term solution*. In such instances, medication may temporarily suppress the symptoms, but leave the underlying psychological cause (e.g.emotinal issues) untouched. In theory, adminintration of medication (in the absence of neurotransmitter imbalance) could actually *create* a neurotransmitter imbalance, and this, in turn, could exacerbate any already existing psychological based attention difficulties. Furthermore, by bringing about an imbalance in the neurotransmitter control of cerebro-cerebellar interactions concerned with cognitive updating, it is conceivable that medication even may create psychological difficulties where previously there were none.

Sources of competing input to the conscious (cerebral) attentive system

- external sensory environment
- internal 'sensory environment' - innate bodily needs

- communication of information from the cerebellum

These can be considered as sources of signal input to *cerebral 'screen' of attentive consciousness*.

Regarding input from the external environment, there may be competition between the different sensory modalities (vision, sound, smell etc.), or between different sources (two different people speaking at the same time).

Input to the conscious cerebral system from the cerebellar system may may be driven by current environmental stimuli (internal or external) and include unconscious 'perceptions' regarding what are significant features of current environmental input (judged in terms of cererbellar priorities), or unconscious cerebellar 'thoughts' (emotions, intuitions) that are elicited by the current environmental stimuli (external and/or internal). Additionally, input from the cerebellum to the cerebrum may be important 're-view' or 'updating' information (for example, flashbacks to real world events, or dream world events), where' importance' is judged in terms of cerebellar priorities and relative to current environmental stimuli (for instance, the cerebellum may determine that nothing of much importance is going on at the moment, so it is a good time forward information to the conscious cerebral mind for its consideration). Recent emotional trauma may increase the need (or 'pressure') for this kind of updating (see earlier, on dissociative disorders and intruisions into consciousness).

Neo-cerebellar sensorimotor output to the cerebrum in 'peripheral consciousness/awareness'?

It is possible that ascending (bottom-up) neo-cerebellar sensorimotor information is always available to the cerebral cortex in the perceptual 'background', through what might be described as 'peripheral' consciousness (analogous to the notion of peripheral vision), that is, a constantly available 'faint' awareness of cerebellar output. However, when cerebral attention is redirected and selectively attends to this ascending neo-cerebellar sensorimotor information, then what was previously in peripheral consciousness or faint awareness, becomes more in full awareness.

As noted elsewhere (Academia.edu paper: Attention: a neuropsychological perspective) there may be a natural ebb and flow of information input from the cerebellum to the cerebrum, rhythmically, over the course of the day. Accordingly, there may be times when it is more easy, and times when it is less easy, to focus on the external world with full attention. As a result, *the effort required to concentrate attention on input from the external world in likely to fluctuate rhythmically*.

Some consequences of simultaneous multiple signal inputs to the 'screen' of attentive consciousness

In theory, from a control system perspective, it is possible that there could be simultaneous multiple signal inputs to the cerebral 'screen' of attentive consciousness. The processes involved in the control of attention will, in part, be concerned with managing the emergence of these competing signal inputs.

It is possible that two signals from different sources, for example, one from the external environment and one from the cerebellum, could impinge on the cerebral screen of attentive consciousness at the same time. In such an event, one possibility is that one of the imputs is stronger and most strongly emergent in the 'minds eye', whilst the other is present as faint background signal (e.g. imagery from the cerebellum) 'ghosting' behind the main signal e.g. (images from the external environment). However, another possibility is that the two inputs are of the same strength, in which case the imagery from the cerebellum would co-occur on the cerebral screen of attentive consciousness (a bit like looking at a screen onto which two different film projectors, showing two different films, are directing their images at the same time), resulting a potentially confusing merger of external 'reality' and internal 'imagination'. Yet another

possibility is that the input form the cerebellum overpowers and largely obscures the input from the external environment, resulting in 'absence' or '*dissociation*' from the input from the external world.

A conscious choice to pay attention to imagery from the cerebellum could be considered as an aspect of introspection – *introspective attention*.

A number of specific 'process related' categories of 'attention deficit' at conscious cerebral level

Regarding attention at a conscious cerebral level, the observable characteristics or symptoms of 'attention deficit' may occur for a number of reasons.

1) Absence of (conscious) attention to 'task relevant' external input features
(task performance being carried out automatically, or in a 'dissociated' state)

2) Externally generated distraction of attention from 'consciously task relevant' external input features to other (task irrelevant) external input features

3) Internally generated distraction of attention from 'consciously task relevant' external input features to other (task irrelevant) input features of a bodily nature concerning basic needs (hunger, thirst, pain etc)

4) Unconscious re-direction of attention from 'consciously task relevant' external input features to other external input features that are unconsciously determined to be important and task relevant

5) Unconscious re-direction of attention from 'consciously task relevant' external input features to other external input features that are unconsciously determined to be important, but task irrelevant

6) Externally generated distraction of attention from 'consciously task relevant' thought processes to task irrelevant external input features

7) Internally generated distraction of attention from 'consciously task relevant' thought processes to other (task irrelevant) input features of a bodily nature concerning basic needs (hunger, thirst, pain etc)

8) Unconscious re-direction of attention from 'consciously task relevant' thought processes to other external input features that are unconsciously determined to be important and task relevant

9) Unconscious re-direction of attention from 'consciously task relevant' thought processes to other external input features that are unconsciously determined to be important, but task irrelevant

10) Unconscious disruption of attention to 'consciously task relevant' thought processes by unconscious thoughts that are important and task relevant (e.g. intuition)

11) Unconscious disruption of attention to 'consciously task relevant' thought processes by unconscious thoughts that are important but task irrelevant (e.g. task associated 'emotion flashbacks'; task unrelated dream backlog information)

The above list of eleven categorical examples is not necessarily exhaustive. Each of the eleven categories of attention 'deficit' could occur for purely 'psychological' reasons (including goals, motivation, associated trauma, updating backlog), Each of them could also occur as a result of inefficient or faulty 'biochemical' activation or inhibition in relation to aspects of the process of information transmission or internally generated information. Furthermore, each could involve a combination of both psychological and biochemical contributions.

Disruption of focused selective attention is not always indicative of dysregulation in the attention process

The symptoms of the above categories of attention 'deficits'(defined in terms of disruption of conscious focused attention on an activity of importance to the conscious cerebral system) could clearly be caused (or allowed to emerge) because of genuine dysregulation of attention, for example, as a result of neurotransmitter imbalance. However, it is important to note that some of the symptoms of the categories of 'attention deficit' may not necessarily be be indicative of dysfunctional activity within the *overall process of attention and attention shifting*, but rather may be seen as 'functional' and necessary in terms of the overall needs/motives of the total brain (brain stem, cerebellum anc cerebrum), and the requirements of the overall hybrid cognitive control system (with its cerebral/abstract and cerebellar/naturomorphic components). In short, ***not all disruption of attention is dysfunctional and indicative of dysregulation!***

A list of some factors that could contribute to the appearance of 'attention deficit'-like symptoms

Intrinsic factors

'Sensitivity' (relatively low threshold for sensory reaction to stimuli)
Level of discomfort in relation to basic physical needs (hunger/thirst, temperature, bodily needs etc)
General anxiety (resulting in increased vigilance)
Associated emotional issues (that may be triggered in relation to a given task)
Recent emotional trauma
Lack of sleep (including dream sleep)
Recent problem solving efforts ("Aha!" intrusion of incubated primary process creative thoughts)

Neurophysiolgical trauma
Neurochemical imbalance/dysfunction

Extrinsic factors

Level of external distraction
Task difficulty (too easy results in no need to make effort, too difficulty results in ceasing to make effort)
Task relevance (relates to importance, motivation, level of interest/boredom)
Task familiarity/predictability (the possibility of functioning on automatic)

The above list of intrinsic and extrinsic factors (some of which obviously relate to Maslow's hierarchy of need) is not considered to be exhaustive, but merely to indicate some of the many and different factors that can impact the ability to maintain focused attention. Some of the factors may be 'transient' (short term or long term), and others may be 'permanent'.

Postscript: the need for an broad/integrative approach to ADHD-ADD

It has been suggested that there is a need for an integrated theory of ADHD-ADD that takes into account biological, neurological, psychological, and psychoanalytic perspectives (Jones & Allison, 2010; Levin, 2002; Maiese, 2012), and that can make sense of the disorders wide range of symptoms (Maiese, 2012).

It is hoped that this introductory paper on ADHD-ADD, together with my related Academia.edu papers listed below, when integrated within the framework provided by *totalBRAINtotalMIND Vol.1. An Integrated Brain/Mind Architecture*, will constitue a first tep towards an integrated theory of ADHD that does justice to its complexity.

* Attention: some psychological aspects
* Attention: a neuropsychological perspective
* Executive function, attention, emotion, and working memory

Eric Parkins
Dec. 2013